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ENGINES OF THE STEAMSHIP PARISIAN.

In our issue of April 1 we illustrated, as an example of one of the latest types of English marine engines, the powerful and compact engines built by R. Napier & Sons, Glasgow, for the steamship Parisian. This vessel is 450 feet long and 46 feet wide, and has 10,000 tons displacement.

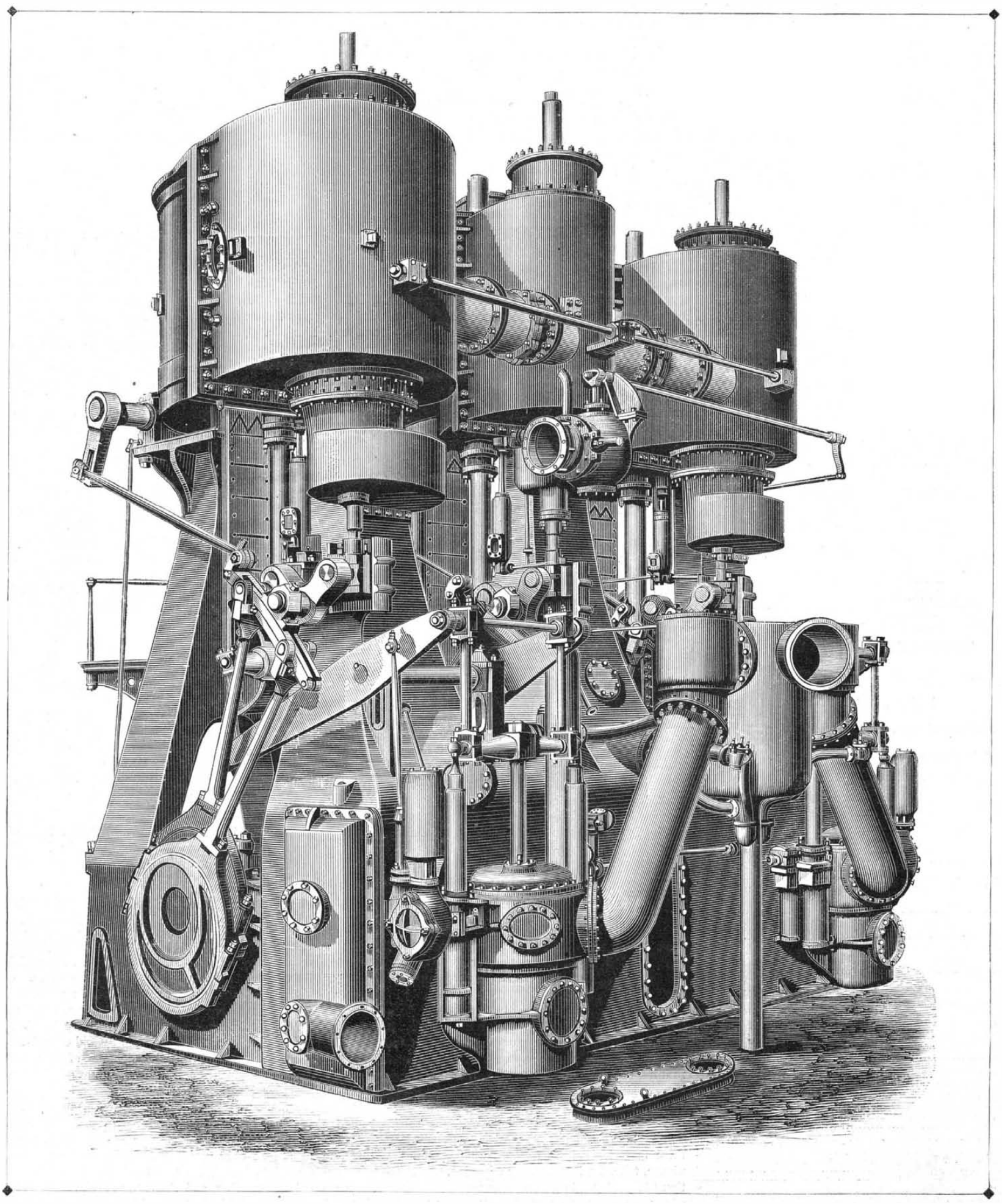
The engines are vertical compounds, of the "tandem" type; that is, with the cylinders in line with the keel. In the previous illustration only the rear of the engines was shown. The accompanying engraving represents the front, and shows the valve and pump gear.

There are three cylinders, one high pressure and two low pressure, which are 60 inches and 85 inches respectively, with 5 feet stroke of piston. The crank shaft is of steel, 20 inches diameter; the crank pins are 21 inches diameter, by the same length. Steam of 75 pounds pressure is used.

The construction and arrangement of the engines is so well shown in the engraving, that we need add but little by way of explanation. The piston valves are worked by a link motion, which is peculiar in some details, especially the rock shaft and levers which connect the link motion with the valve stems.

These engines are handled for reversing or going ahead by a single steam cylinder, which is located behind the central main cylinder, connecting directly by a rod with the reverse shaft, the arm of which is shown in the engraving, and the air pumps are worked directly from the cross head of the main engines, instead of by a separate engine.

These engines were run at 85 revolutions per minute, at which speed they indicated 6,020 horse power. This very high piston speed shows to what perfection modern workmanship has attained when it is possible for even a short time.—*Engineer.*



THE ENGINES OF THE STEAMSHIP PARISIAN.

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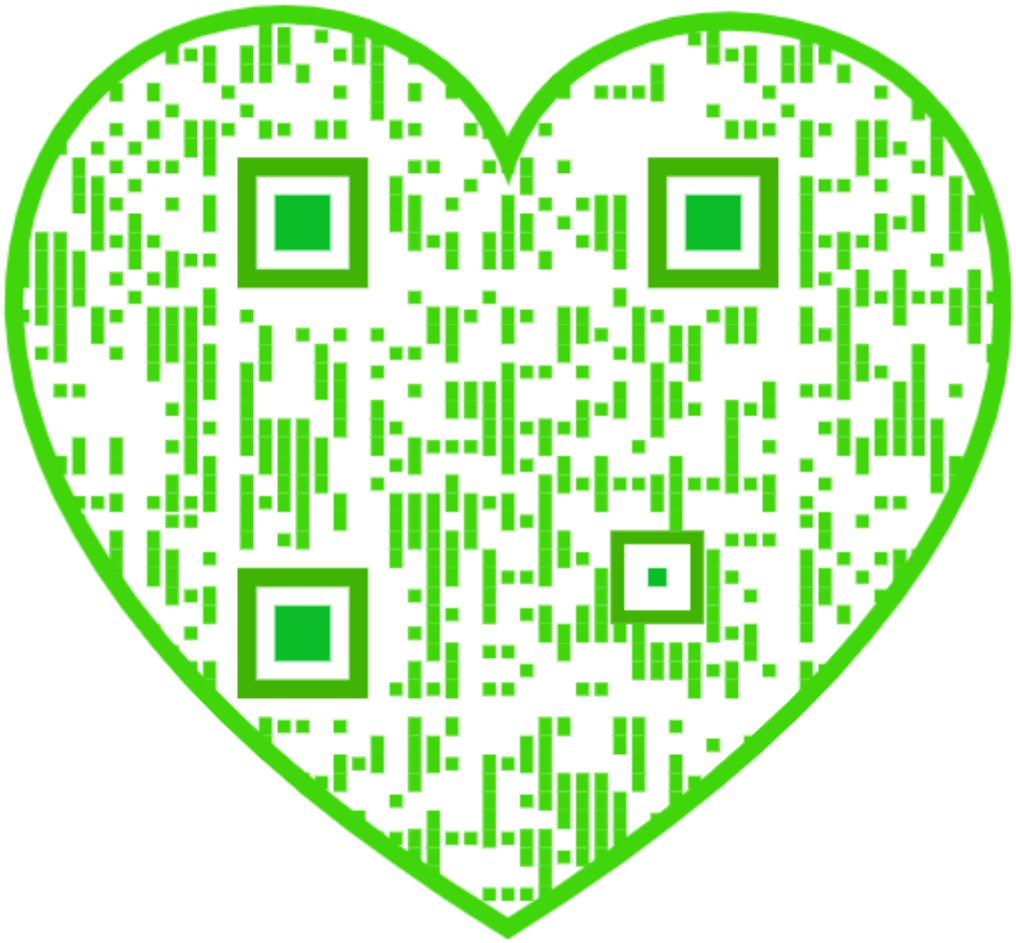

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NEW YORK, SATURDAY, MAY 6, 1882.

Contents.

(Illustrated articles are marked with an asterisk.)

Acid, gallic, solvent for..... 281
Acid sol., act. of on stan. oxide.. 276
Amer. railway superintendents.. 274
Ancient Chinese coins..... 281
Ancient Grecian cuirass..... 277
Arsenic, how detected 273
Bessemer's bronze powder..... 272
Boiler and furnace, improved*.. 278
Brainerd Sumner, the 273
Bugs, curious, some*..... 279
Cable connection with Germany. 276
Canal, Welland, new..... 279
Canals on the planet Mars..... 273
Cause and effect of strikes..... 277
Central America discoveries..... 282
Chinese coffins, ancient 281
Cuirass, Grecian, ancient..... 277
Curious bugs, some*..... 279
Darwin buried in West. Abbey.. 273
Deafness and wisdom teeth..... 281
Digitated stockings..... 277
Discoveries in Central America. 252
Drainage of the City of Mexico.. 281
Electric light companies..... 273
Electric lighting in N. Y. city .. 281
Elevated railways in N. Y. city .. 281
Engineering inventions..... 275
Engine, gas, improved*..... 275
Engines of steamship Parisian*.. 271
Fast railway speeds..... 273
Fence, improved*..... 277
Fishing in a cornfield. 276
Furnace and boiler, improved*.. 278
Gallic acid, solvent for..... 281
Gas engine, improved*. 275
Germany, cable connection with. 276
Grecian cuirass, ancient..... 277
Heat, power, etc., at little cost.. 272
History, prod., etc., of sugar..... 280
How the manuf. helps farmers.. 277
Inventions, engineering..... 275
Inventions, mechanical..... 274
Inventions, miscellaneous..... 279
Inventions, new..... 278
Inventions, recent..... 274
Inventions, small, protection of. 272
Light, heat, etc., at little cost.... 272
Lighting, electric, in N. Y. city.. 281
Log, ship's, novel*..... 278
Lutorcine 275
Mars, planet, canals on the..... 273
Mayor, fourth time as 276
Mechanical inventions..... 274
Microscopic notes..... 282
Notes and queries..... 283
Oxygen, cheap..... 278
Pantaloons protector*..... 276
Parasite, St. Gothard, in India... 278
Parisian, engines of the*..... 271
Pear, prickly, the, as a fence..... 276
Phosphorescence in plants..... 282
Powder, bronze, Bessemer's..... 272
Power, light, etc., at little cost.. 272
Protection of small inventions... 272
Railway progress in the S. W.... 278
Railway speeds, fast..... 273
Railway superintendents, Am... 274
Railways, elevated, in N. Y. city. 281
Schooner, steam, a..... 273
Sewage machine*..... 275
Ship's log, novel*..... 278
Small inventions, protection of.. 272
Solvent for gallic acid..... 281
Steamship Parisian, engines of*. 271
Steel manufacture, imp. in..... 276
St. Gothard parasite in India..... 273
Stockings, digitated..... 277
Strikes—their cause and effect... 277
Stripping a neg. film from plate. 276
Sugar cane, production in 1879... 281
Sugar—its history, etc..... 280
Superintendents, railway, Am.... 274
Teeth, wisdom, and deafness.... 281
Thomson, Sir Charles Wyville*.. 274
Track, cost, etc., of one mile..... 276
Washing machine, improved*.... 274
Welland Canal, new..... 279
Wisdom teeth and deafness..... 281
Zinc, boiling point of..... 274

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 331,

For the Week ending May 6, 1882.

Price 10 cents. For sale by all newsdealers.

PAGE

I. ENGINEERING AND MECHANICS.—Thomas Aveling. The "Father of Traction Engines." 1 figure. Portrait 5271
American Passenger Locomotive. 1 figure. American Express Passenger Locomotive recently sent to England..... 5271
On the Triple Expansive Engines of the Steamship Aberdeen. By A. C. KIRK..... 5272
New Torpedo Boat for the Argentine Republic. 1 figure..... 5273
The Hudson River Tunnel. By S. H. FINCH. 1 figure..... 5273
Weymouth Harbor Bridge. 11 figures. Perspective, plans, elevations, details..... 5274
Description of the Davis Island Coffer Dam of 1881. By WM. MARTIN..... 5275
Poirot's Elevator Truck. 2 figures..... 5276
Bollman's Automatic Emery Grinder. 1 figure..... 5276
Machine for Sharpening and Setting the Teeth of Band Saws. 1 figure..... 5276
Petroleum as Fuel..... 5277
Formula and Tables for the Horse Power of Leather Belts. By A. T. NAGLE..... 5277

II. TECHNOLOGY AND CHEMISTRY.—The Manufacture of Leather 5278
Veteran Carpet Patterns. 2 figures. Eagle Pattern.—Hartford Pattern..... 5279
Washing Wool, and its Loss by Weight. By W. J. MENZIES..... 5279
Damping Machine for Textiles. 2 figures..... 5280
Color Designs on Paper.—2 figures..... 5280
Dry Plates for Transparencies..... 5281
Coating Paper with Gelatine Chloride or Bromide. By T. G. WHAITE. 2 figures..... 5282
An Investigation upon the Values of the Various Methods Used in the Determination of Tannic Acid. By NELSON H. DARTON.—Part I..... 5283

III. SOCIETY MEETINGS.—New York Academy of Science.—Iron and Steel as Building Materials By Prof. EGLESTON.—Psychological Explanation of Salem Witchcraft and the Practical Lessons Derived Therefrom. By GEO. M. BEARD, M.D..... 5282
American Chemical Society.—On the Estimation of Copper. By P. CASAMAJOR.—On the Determination of Tannic Acid. By NELSON H. DARTON..... 5283

IV. ELECTRICITY, MAGNETISM, ETC.—New Form of Electro-Magnet. By Prof. FRED. ARZBERGER. 2 figures..... 5281
Arrangements for Lighting Residences of W. H. Vanderbilt.—1 figure..... 5281
Apparatus for Lighting Gas Burners..... 5282

V. ASTRONOMY.—Comets. Part II. By RICHARD A. PROCTOR.—11 figures.—Donati's comet, September 24, 1858.—Donati's comet, September 26, 1858.—The comet of 1811.—Comet of 1861.—Biela's comet before and after its division..... 5284

LIGHT, HEAT, AND POWER AT LITTLE COST.

Among the most interesting exhibits to be seen at the Electrical Exhibition now going on at the Crystal Palace, London, is the new secondary electrical battery of Sellon and Volkmar, the operation of which appears to mark the opening of a new era in electrical progress. If all that is said of the new invention be true, the storage of power by electrical means is now reduced to commercial practice, and, as results, we may soon expect to observe some curious changes in the arts, habits, and wants of the people.

For example, anybody who chooses to put a windmill upon his house or barn will be able, by means of the secondary battery, to light his dwelling at night, supply it with heat and hot water for washing and cooking, drive sewing machines, churns, washers, pumps, keep electrical carriages that will run anywhere about town without horses, do his plowing, draw mowers, reapers, seeders, propel boats, and perform almost any sort of work that may be required. The rotation of the windmill, running day or night steadily or intermittently, costing nothing except repairs, will have its power stored up and held in the secondary battery, and by the touch of a button to be instantly delivered and put to use when wanted in the form of light, heat, or power. The battery forms in effect a reservoir of force, which when connected with an electrical lamp yields light, or with an electric machine yields heat or motive power. Furthermore, the battery is quite portable, and may be placed in an ordinary carriage, giving motion thereto, like a locomotive. But there is no boiler to explode, and no fuel or water to be supplied. Women and children may safely use it. Every class of society, from highest to lowest, every art and industry in the civilized world, will benefit by its adoption. These, we say, are only some of the indicated uses and advantages of the new invention, if all that is claimed for it be true.

A trial and exhibition of the new battery was lately given at the Crystal Palace, before a large number of distinguished guests, among whom were Mr. Warren de la Rue, Professor Crookes, Professor Hughes, Professor Dewar, Dr. Huggins, Alexander Siemens, Professor Thompson, Professor Adams. Mr. Sellon, the principal originator of the invention, was called on for a speech and gave the following particulars. He stated that the capital stock of the new company, "The Electrical Power Storage Company," was $4,000,000, that it was all subscribed within a few hours, and that he could have obtained ten times the amount had he desired. The distinctive peculiarity of the Sellon-Volkmar battery is that the plates composing the cells are made of perforated plates, the oxides used being held by and within the perforations. Heretofore, as, for example, in the Faure battery, it has been necessary to hold the oxides in contact with the plates by means of packings or wrappings of cloth or other fibrous substances, the use of which was always attended with expense and difficulty, and has prevented the actual success of the instrument. The action of the acids soon destroyed the wraps.

In this new form of battery all the clumsy wrappings are removed, and simple perforated plates are used, the result being the production of durable and more powerful cells than heretofore. Mr. Sellon said that he looked forward to the time when huge plates of half a ton or a ton each will be used, and thousands of lamps supplied from one battery or reservoir. He further said:

"Of the sizes now made, one standard size of the dimensions of forty-three one hundredths of a cubic foot, and containing of metallic composition about 62 pounds, will yield when properly charged an aggregate amount of current equivalent to fully one horse power of electrical energy for one hour, giving off from 350 to 400 amperes at any required rate up to 40 amperes per hour. The next standard size contains of metallic composition rather less than 300 pounds, and can yield five horse power of electrical energy for an hour—giving up its 1,800 to 2,000 amperes at any rate up to 200 or 250 if required. One set of 39 such cells will be seen working 200 Lane-Fox lamps in the Alhambra Courts. The plates have no supports, and are simply in appearance solid pieces of metal separated by slips of wood, and immersed in acidulated water. In reality they are full of interstices or holes, which contain the packed material. This is applied in such a form that it makes a solid alloy (if I may use the term) with the plates themselves."

He then proceeded to request that a scientific committee should be appointed to examine and verify his statements and test the battery. He then continued:

"Now as to the practical application of these batteries. To my mind their employment will be almost unlimited. I can conceive no installation of domestic electric lighting to be complete without them, whether as a supplying or as a regulating medium. For motive power I anticipate immense demand; and although the factory now nearly in course of construction is upon a scale somewhat commensurate with the business in hand, yet I feel confident that it will form but the nucleus of an immense and important industry.

"The application of the forces of nature, such as wind, running and tidal water power, will now, doubtless, receive more engineering attention than heretofore; and electrical energy, which upon its generation can now be stored and reserved for use as required, must become a much sought for and highly prized source of power. To regard the use of these batteries only as a small matter of personal convenience, take, for instance, my own case. Up to the introduction of these batteries it had been necessary for me to keep one of my gardeners every evening attending to the engine and dynamo machine up to whatever hour light might be required; for the future he need only set the charging of the batteries in action during the day, and my store will be ready for evening use without fluctuation or intermission. The durability of the incandescent lamps is also greatly increased, and the lights can be regulated to any required degree of intensity if you diminish your electromotive force by cutting off so many cells, and you thereby conserve so much of your electrical power."

The practical exhibition of the new battery is described as having been attended with great success. Many lights were shown, the brilliancy of which could be readily increased or diminished by switching on or off one or more cells of the battery.

THE PROTECTION OF SMALL INVENTIONS.

A characteristic feature of the American patent system, and one toward which the patent laws of other countries have been steadily approximating, is the encouragement which it offers to all men, poor as well as rich, to make inventions and publish them to the world under the protection of letters patent. The smallness of the official fees and the exceptionally thorough protection offered have been very fruitful in calling out and making public inventions which, like the Bessemer bronze powders (elsewhere commented, upon), are easily open to spoliation; hence the rapid and enormous multiplication here of individually small devices which have had in the aggregate such a shaping, helping, and enriching influence upon all our industries. Not unfrequently has it happened that seemingly minute and unimportant devices, inventions which could not have been patented elsewhere or which the inventors would have been unable to patent on account of the cost, have here brought liberal fortunes to their patentees, vastly greater profit to the public, and sometimes have furnished the beginnings of great industries.

Such results are possible only where the inventors' rights, easily secured, are rigorously guarded. One of the strongest safeguards to patents upon easily marketable inventions of general utility is the law which makes the buyer of infringing devices measurably responsible for the wrong done the rightful patentee, thereby spoiling the market for dishonest and unlawful products. This vital truth has repeatedly been recognized by past Congresses, and quite recently again by the Congress now sitting in Washington, in defeating projects calculated to sacrifice the rights of patentees of articles of small market value. The action of the Senate upon Senate bill No. 1238, a few days ago, may serve as an example. The first section of the bill provides that in suits for infringement, where the defendant's purchase was made "in good faith for his own use and not for sale, and not in any manufacturing process," the plaintiff must recover $20 or he cannot recover costs; while the second section requires the plaintiff to deposit "a reasonable sum not exceeding $50," as security for the defendant's costs and expenses.

The chairman of the Senate Patent Committee strenuously urged the passage of this bill; but the objections to it were so strong that it was withdrawn, it is to be hoped permanently. The provisions of the bill (as will be obvious to any one) would reach a very numerous class of patentees whose rights would be sacrificed entirely.

A still more reprehensible attempt to remove the legal safeguards of patentees is said to be favored by the Patent Committee of the House. According to the *Evening Post* of April 25, the committee that day directed a favorable report to be made to the House on a bill providing that no action for damages or proceeding in equity shall be sustained, nor the party held liable under sections 4919 or 4921 of the Revised Statutes, for the use of any patented article or device, "when it shall appear on the trial that the defendant in such action or proceeding purchased said article for a valuable consideration in the open market."

It is incredible that the House can lend itself to the furtherance of a measure so palpably intended to lay the property rights of patentees open to general invasion. Still less possible is it that both Houses can agree to such an unjustifiable reversion of the spirit which has thus far ruled in American patent legislation. There must be some mistake in our contemporary's report of the committee proceedings. The country is too deeply indebted to the ingenuity of our inventors, and has too much to hope for from the future working of their genius, to abandon the profitable practice of dealing justly with and by them.

BESSEMER'S BRONZE POWDER.—HOW THE PUBLIC GAINS BY GRANTING PATENTS FOR INVENTION.

About forty years ago Mr., now Sir Henry Bessemer, had occasion to buy some bronze powder, for which he was charged seven shillings (about $1.75) an ounce. On examination he found that the metal of the powder was worth less than a penny an ounce. So large a margin for profit set him to thinking, and his thinking resulted in a machine for making bronze powders rapidly and cheaply.

Having small faith in the adequacy of the protection rendered by the patent laws of England as administered at that time, Mr. Bessemer determined to keep his invention secret. He made working drawings of the machinery, and had the various parts constructed by different machinists in Liverpool, Manchester, Birmingham, and London, so that no one should be able to guess what the entire machine was intended to be. With two trusted assistants he put his machinery together, and thereafter only himself and those two ever entered his factory. At first he charged eighty shillings ($20) a pound. The same machines, under the super-

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intendence of the same men, are now producing precisely the same article, which sells for two shillings and six pence a pound, less than one-thirtieth the former price.

Had Mr. Bessemer been sure of protection under a patent he would gladly have made public his invention at once, and would have surrendered the control of it at the end of the period of protection—fourteen years. Being fortunate in his choice of confidential assistants, he was able to guard his secret many years longer, and the public had to pay for his caution and success in a vastly augmented price. In the meantime the public lost the incalculable advantage of the new knowledge which the invention contained, and which, without infringement upon Mr. Bessemer's rights in the manufacture of bronze powder, might have been widely employed in the advancement of related arts.

The inadequate protection of new inventions thus works public injury and loss, not only by discouraging invention, but still more by smothering new knowledge. Discoveries which might work economic revolutions in many arts are kept secret, to be applied cautiously to some narrow use in a single art; or the discoverer, having no means of applying his discovery, and being unable to invite assistance without risk of losing his secret, keeps his knowledge to himself in the hope of eventually turning it to profit. The time for the utilization of the discovery passes, or the holder of the secret dies, and the world loses the good it might have had were its treatment of inventors juster. This was the experience of the world everywhere down to very recent times; and the same unprofitable practice still keeps in industrial immobility a large part of humanity. The growing judgment of the world is that the best way to advance the arts is to multiply inventions; and that the cheapest way to encourage inventions is to protect the property rights of patentees. This would be public policy even were it reasonable to suppose that without patent laws the same inventions would be made and developed as trade secrets as are now publicly developed under letters patent. Every important discovery or invention sets a multitude of other thinkers at work, and is the parent of many more inventions, provided it promptly enters into the world's stock of new knowledge; and the incidental advantages thus accruing more than recompense the public for any inconvenience and loss arising from occasionally mismanaged patent rights.

In the case of Mr. Bessemer's bronze powders the high market value of the product, and the comparative ease with which his invention might be infringed, together with the uncertainty of protection under the existing patent laws, practically drove him to secrecy. Since then the protection of inventors' rights under English patents has been greatly improved, and Mr. Bessemer has freely taken advantage of them, greatly to the advantage of England and the entire industrial world.

Canals on the Planet Mars.

A curious discovery, made by Signor Schiaparelli, Director of the Royal Observatory at Milan, seems to start again that old and unanswerable question, "Are the planets inhabited?" This Italian astronomer is one of the most assiduous watchers of the planet Mars. It was he who, in 1877–8, first detected the many dusky bands which traverse and subdivide the ruddy portions of the martial orb. Again, in 1879–80, when the position of the planet was favorable, he reidentified these strange lines; but during last January and February he has been able to observe and map out in more than twenty instances duplications of the dark streaks "covering the equatorial region of Mars with a mysterious network, to which there is nothing remotely analogous on the earth." The Italian astronomer has styled them "canals," for they bear the appearance of long seaways, dug through the martial continents, as if a mania for short cuts had seized the inhabitants of the planet, and everybody residing there had become an active M. de Lesseps.—*London Telegraph.*

Further Consolidation of Electric Light Companies.

About a year ago the Gramme Electrical Company was formed by a combination of the leading companies owning patents for arc lights and machinery for generating electricity for such use. Recently the combination has been strengthened by union with the Edison Company, thus giving the Gramme Company control of all the leading systems of electric lighting. The combination now comprises the American Electric Company, the Brush Electric Company, the Edison Electric Light Company, the Fuller Electrical Company, the Jablochkoff Electric Lighting Company, the United States Electric Lighting Company, and the Weston Electric Lighting Company, in addition to the original company owning the Gramme patents. Before the last consolidation the Gramme Company controlled all the patents for working arc lights, and now it practically monopolizes incandescent lighting also. The combination would appear to have been made chiefly to prevent litigation between the combining companies and to facilitate the suppression of organizations not in the ring by litigation, or competition, purchase, or otherwise.

Mr. Darwin Buried in Westminster Abbey.

The funeral of the eminent scientist, Charles Darwin, took place in Westminster Abbey, April 26. The pallbearers were United States Minister Lowell, the Duke of Argyll, Lord Derby, Professor Huxley, Sir Joseph Hooker, Sir John Lubbock, Alfred Russel Wallace, and William Spottiswoode. The procession was merely within the precincts of the Abbey. Lord Salisbury, Lord Aberdare, Sir Charles Dilke, Sir Rutherford Alcock, Mr. Mundella, Right Hon. Edward Gibson, Mr. Thomas Burt, Professor Tyndall, Mr. John Morley, Mr. Herbert Spencer, Vice Chancellor Evans, and Professor Jowett, the last two being members of a deputation representing the University of Oxford, were present at the funeral service, besides numerous members of Mr. Darwin's family and deputations from learned societies.

Who would have dared to predict, twenty years ago, that the authorities of conservative England would so soon and so conspicuously recognize the merit of the author of the "Origin of Species through Natural Selection?" Or in what other age of the world could so radical a revolution in men's interpretation of the facts of life and nature have been wrought during the lifetime of one man?

How a Scientific Man Detects Arsenic.

Recently during the trial of the Malley brothers for murder, at New Haven, Conn., Prof. R. H. Chittenden, a young man, instructor in physiological chemistry, Yale College, testified as follows:

"I made a chemical examination in a room in the college to which no one had access but myself. The doors were doubly locked, and, in my absence, sealed. On the 16th of August I opened the jar labeled 'Stomach and œsophagus.' I poured the contents into a clear porcelain dish. They weighed 603 grammes, or 1 pound 5 ounces and 118 19-100 grains avoirdupois. The fluid contents had the odor of alcohol, and were distinctly acid in reaction. The stomach had already been opened. Nothing abnormal was observed in its lining. I then sampled the mixture preparatory to analysis. I cut the stomach into small shreds, transferred them to a mortar and ground them into a liquid mass. I next weighed off from this mixture 266 grammes, equal to 9 ounces and 167 2-5 grains. I subjected this to evaporation or distillation at a gentle heat. In the distillate I could detect only alcohol. I examined the residue for organic or alkaloid poisons. All the residue retained failed to give any reaction to chemical reagents, or when given to animals. I found no trace of organic or alkaloid poisons. Sometimes they can be obtained by physiological tests when chemical tests fail. Eighty-eight grammes, or 3 ounces 45½ grains, of this stomach mixture were then weighed out, and tests were applied for mineral poisons. They revealed traces of a substance bearing a resemblance to arsenic. It was got in the form of a dark metallic body."

The Professor stooped down and raised a mahogany case filled with little glass vials, all numbered. It was similar to the one used in the Hayden trial. He laid it on the Judge's bench. It was afterward transferred to the table in front of the jurors. Glass bulbs and tubes, a Marsh apparatus, an alcohol lamp, a porcelain bowl, vials filled with acids, and other chemical paraphernalia were placed on the District Attorney's table. A white rubber tube connected it with the gas bracket over the witness box.

"In addition to the substance bearing a resemblance to arsenic, I got seven milligrammes of oxide of iron," he said. "I calculate that the stomach and contents contained 739-1,000ths of a grain of this oxide. I dissolved it in hydrochloric acid, making it chloride of iron. It is the fifth exhibit [pointing to a vial in the mahogany case]. I next identified the arsenic, and ascertained the amount. I weighed out another 100 grammes of the stomach mixture, 3 ounces 230 3-5 grains. I weighed it in a porcelain bowl. 223 centimeters of nitric acid were added to the mixture. I placed the bowl in an air bath, heated at 150 degrees, nearly 380° Fahrenheit. In this way all the tissue was dissolved and converted into liquid. The arsenic present was converted into arsenic acid. This heating on the air bath was continued for nearly two hours. The liquid then took on an orange color. I am particular in detailing this operation because in this work I have repeated it nearly sixty times. When the orange color appears, three cubic centimeters of pure sulphuric acid is added to the mixture. This produces a very violent oxidation or combustion.

"The organic matter of the tissue is converted into carbonization like charcoal. The arsenic acid still remains. While still heated, eight cubic centimeters of pure concentrated nitric acid, were drop by drop, added to the mixture. The mass was then heated fifteen or twenty minutes longer. The destruction of the organic matter was then complete. A dish containing the carbonaceous matter was then filled with distilled water. It was allowed to soak twenty-four hours. In this way the arsenic, as arsenic acid, is dissolved out of the water, and the carbonaceous matter left undissolved. The clear solution containing arsenic, with a little coloring matter, is then evaporated to dryness, being heated by steam. The residue contains all the arsenic originally in the tissue. This residue is then dissolved in very dilute sulphuric acid. This solution is then gradually introduced into the Marsh apparatus. In this apparatus [holding up a bulbular glass instrument], thirty grammes of pure zinc, alloyed with a little platinum, is placed. Then a small quantity of sulphuric acid is poured in, which, acting on the zinc, generates hydrogen gas. This gas issues from a tube like this [attaching a glass tube like the spout of a pump to the Marsh apparatus]. It then passes through this tube [exhibiting another tube], called the chloride of calcium tube. This dries the gas, and frees it from moisture. The gas then passes through a longer and smaller glass tube [showing it], and finally issues in a jet, which when lighted gives a colorless flame. When the apparatus is filled with hydrogen gas, the substance under examination for arsenic is poured into the upper bulb of the Marsh machine [showing the bulb]. A glass stop cock [illustrating] is then turned, and the fluid flows, drop by drop, into this lower bulb, into which the hydrogen is being constantly evolved. In this manner the solution containing the arsenic is brought into contact with the hydrogen. The arsenic combines with the hydrogen, forming a gaseous compound, called arseniureted hydrogen. The arseniureted hydrogen ultimately passes through this narrow glass tube [showing tube]. This tube is placed over a small glass furnace [exhibiting a furnace]. By the action of these three lights [showing lights in furnace] six inches of the tube are heated to a red heat. As the arseniureted hydrogen passes through this six inches of tube, it is decomposed into metallic arsenic and free hydrogen. The hydrogen passes off, and the metallic arsenic is deposited at the cold end of the tube. The apparatus is allowed to run until the zinc is completely dissolved. This usually takes from three to four hours. It depends upon the rapidity with which the gas is evolved. As the first portion of the acid flows into the bulb a second portion of stronger sulphuric acid is added, and allowed to flow under the zinc. Lastly, a third portion of still stronger sulphuric acid is added. These serve to completely change the arsenic into arseniureted hydrogen, and the entire amount of metallic arsenic is deposited on the inner surface of the glass tube. The apparatus is then taken apart, and the portion of the tube containing the metal is cut out with a file. [The Professor illustrated by cutting a tube with a file.] Thus a piece of glass is secured which contains all the metallic arsenic. The tube, plus the arsenic, is then carefully weighed. Then the incrustation of arsenic is dissolved by nitric acid. The tube is rinsed with water, and finally dried. It is weighed. The difference between the first and second weighing is the weight of the metallic arsenic. My hundred gramme sample of the stomach mixture, treated in this manner, gave a metallic deposit, which weighed 1 3-10 milligrammes.

"I calculate from my analysis of the 100 grammes of stomach mixture," Professor Chittenden continued, "that the whole 603 grammes contained 79-500ths of a grain of arsenic. I next verified the result already obtained. I dissolved the metallic arsenic in nitric acid, and evaporated the solution to dryness. It left a white residue. This residue dissolved completely in a drop of water. I then added a little solution of nitrate of silver, which gave a heavy brick-dust red precipitate of arsenate of silver, soluble in ammonia and soluble in nitric acid. I identified the substance as the white oxide of arsenic beyond the shadow of a doubt. It is the same as that sold at stores under the name of arsenic."

The Professor said that he next weighed out 106 grammes, or 3 ounces 323¼ grains of the sample stomach mixture, and treated it in the same manner as he had treated the preceding portion. He got from it 1 7-25 of a milligramme of metallic arsenic. This demonstration proved to his mind that the arsenic was evenly distributed. There still remained 43 grammes of this sample stomach mixture. He oxidized this in the same manner, and obtained from it metallic arsenic. He proved it by a different process from the first. He used various processes in proving his demonstrations, with the same result. The arsenic was always there. The liver, kidney, heart, lungs and spleen, brain, trachea, diaphragm, and intestines were similarly examined. The total amount of arsenic obtained from these organs was 1 grain and 847-5000ths of a grain.

The Brainerd Sumner.—A Steam Schooner.

A vessel of a novel type recently arrived at this harbor from Rockland, Me. It is called the Brainerd Sumner, and in general appearance closely resembles the ordinary large three-masted schooner. A closer inspection shows that the mizzenmast is painted black, while the foremast and mainmast are slushed and scraped down in the ordinary way. It is necessary to board this queer craft to ascertain that the third mast is really a tall smokestack of iron, similar in shape to the two other masts. It has a topmast like the others, and a fore and aft sail like them, with the ordinary gaff and boom, which have jaws working on the smokestack as on any other mast. A small steam whistle is alongside the mizzenmast. The engine and boiler are in the extreme after part of the vessel. The furnace and boiler are athwartships, and the engine is an upright propeller of the ordinary type. The steam power is intended as an auxiliary, but she has made seven knots an hour under steam alone She was built in Rockland a short time ago, and is the first vessel of the kind ever constructed. She is about 600 or 700 tons Custom House measurement.

Fast Railway Speeds.

We have received from Mr. J. J. Burleigh, chief operator, West Jersey Railway, his certified copy from the register of trains of the performance of the special passenger train, on the above road, on Saturday, April 22d last. Conductor, Mayhew; engineman, Reinhart; engine No. 22 (class C, anthracite), burning bituminous coal; combined car No. 375, passenger cars Nos. 369 and 600; number of passengers on train, 124. The following time was made: Between Glassboro and Vineland, 16½ miles, 14 minutes; between Woodbury and Court House, 61$\frac{1}{10}$ miles, 60 minutes; between Westville and Cape May, 76$\frac{1}{10}$ miles, 76 minutes. This is certainly very fast running.

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MECHANICAL INVENTIONS.

Mr. William Rowe, of Biddeford, Me., has devised and patented an improved lock, which can only be locked or unlocked by a person acquainted with the combination of the several parts to which these parts have been adjusted. The invention consists in a combination lock constructed with a sliding bolt provided with two tongues fitting into recesses in two side disks on two spur wheels engaging with pinions mounted on a shaft and its surrounding sleeve, both the shaft and sleeve having each a hand at the outer end, these hands being over a dial in the outer surface of the lock casing. The spur wheels are loosely mounted on pintles attached to slides, by means of which the lock can be adjusted to be opened at a certain position of the hands on the dial. At all other positions of the hands the lock cannot be opened, and to open it the hands must be returned to their original position on the dial, for thereby the inner mechanism will be brought to its original position, permitting the tongues on the bolt to pass into the recesses in the cog wheel.

An improved oatmeal machine has been patented by Mr. Anton Heinz, of Muscatine, Iowa. In this machine the oats enter a trough-like receptacle, one side of which is formed by a plate, which may be stationary or movable, having recesses or passages for reception of the oats and discharge of the same. In connection with this plate the inventor employs for cutting the grain knives which may be movable or stationary (being movable the plate is stationary, or *vice versa*). The size or grade of the product is regulated by providing interchangeable plates having large and small recesses, or providing suitable adjustable means for increasing and diminishing the size of the recesses.

Mr. William J. Barber, of Covington, Ind., has patented an improved prospecting drill, which is simple, light, durable, can be transported very readily, and can be operated conveniently by one man. The invention consists in a drill held adjustably in a stock having its lower end grooved spirally, and provided with a loose ring with a projection resting on a cam wheel pivoted to a suitable frame, also carrying an adjustable circular plate provided with a tubular casing for a pressure spring and the drill stock, which plate is also provided with a tubular guide on the same diametrical line with the casing, and for the purpose of guiding the drill. The cam plate is provided on its inner surface with studs, which enter the spiral grooves of the stock when the cam wheel rotates, thereby rotating the stock and the drill held therein.

IMPROVED WASHING MACHINE.

The annexed engraving shows an improved washing machine recently patented by Mr. Benjamin F. Cokely, of Vinton, Iowa. The box of this machine is composed of two circular side pieces and a curved zinc bottom secured to the side pieces with intervening strips of cloth saturated in paint to prevent leakage. The curved zinc bottom is provided with rounded transverse slats upon which the clothes rest.

The convex rubber is composed of two parallel semicircular boards having semicircular notches in which are secured parallel round rods. The rubber is provided with vertical arms connected at the top by the handle by which the rubber is operated.

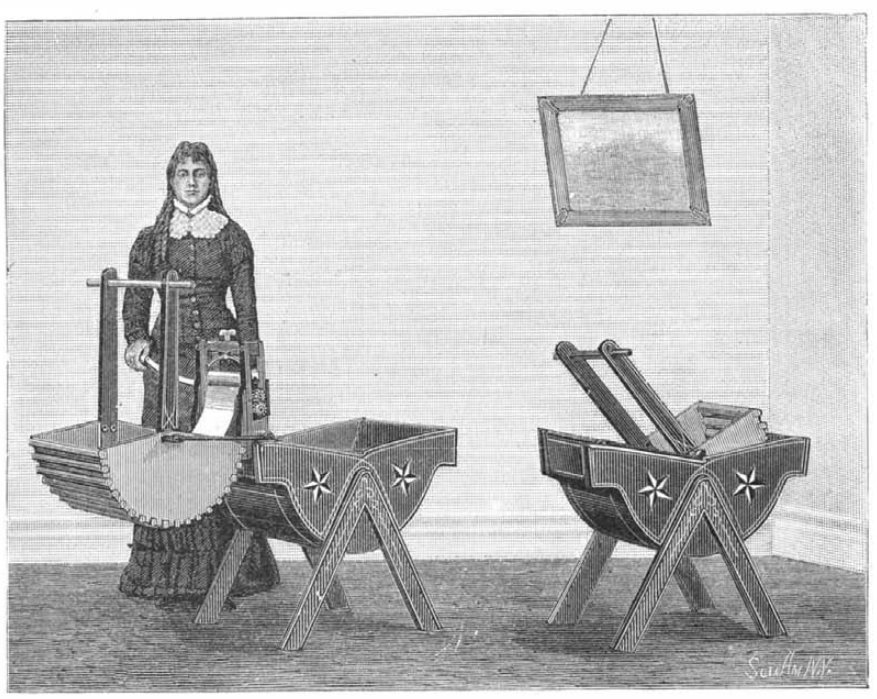
The rubber is hung on a rod bent twice at right angles, so that it may be lifted out of the box and supported out of the way when desired. When the rubber has been thus swung over and out of the box, as shown in one of the views, sufficient space intervenes between the end of the box and the end of the rubber for the introduction of a wringer which is clamped to the end board of the box. The washed clothes in the box are then introduced by the operator into the wringer, which conveys the clothes into the rubber, which thus serves as a receptacle for the clothes after having been wrung, the open bottom allowing the water remaining in the clothes to escape between rounds.

It will be observed that both ends of the box are raised. This is especially necessary for that end of the box in which the rod is journaled, so that when the clothes are under the rubber the rod may be level.

While operating the machine the clothes may be shifted in the box by slightly raising the rubber at intervals by the handle without interfering with the regular motion of the machine.

By the peculiar construction of rubber, with an open space between its side boards and opening between the rods forming its bottom, in the oscillations of the rubber the water is prevented from being thrown out of the box at its ends.

Further information in regard to this useful invention may be obtained by addressing the inventor as above.



COKELY'S WASHING MACHINE.

American Railway Superintendents.

The Association of American Railway Superintendents met in annual convention in this city April 19, Peyton Randolph, of the Virginia Midland Railroad, in the chair. The main work of the day was a consideration of train rules and signals. The idea was to adopt a system for use on all the railroads of the country. At present, it was said, one road used the signal to stop that another did to start. Where roads joined, the signals were ofttimes conflicting and dangerous. Major E. T. D. Myers, of the Richmond, Fredericksburg and Potomac Railroad, said that it was found that everybody's rules were different and that nobody's were carried out at the Spuyten Duyvil disaster. A code of whistle signals was considered and recommended to a committee appointed to prepare a code for adoption. A code of conductors' signals was also recommended for adoption.

SIR CHARLES WYVILLE THOMSON.

Sir Charles Wyville Thomson, the distinguished naturalist, who died recently at the comparatively early age of 51, was the son of Mr. Andrew Thomson, a surgeon in the H.E.I.C.S.

SIR CHARLES WYVILLE THOMSON.

He was educated at Merchiston Castle School, and subsequently at Edinburgh University. In 1850 he was appointed Lecturer on Botany in King's College, Aberdeen, and in the following year held the same post in the Marischal College and University of Aberdeen, while subsequently he became successively Professor of Natural History in Queen's College, Cork, and Professor of Mineralogy and Geology in Queen's College, Belfast, where he helped to found a museum in connection with the College, and to organize a School of Art under the Science and Art Department. He was vice-president of the jury on Raw Products at the Paris Exhibition of 1867, and in the two following years he went on scientific dredging expeditions in the Lightning and the Porcupine. In 1870 he was chosen Regius Professor of Natural History in the University of Edinburgh, and in 1872 he was placed at the the head of the scientific department of the famous Challenger deep sea exploring expedition, an appointment for which he was eminently fitted by his various scientific attainments. On the return of the Challenger, after her three years and a half cruise round the world, Professor Thomson received the honor of knighthood. The collections obtained during the voyage were deposited at Edinburgh, and Sir Charles undertook the work of reporting the scientific results of the cruise, a task which he partially achieved by the publication, in 1877, of the first volume of the "Voyage of the Challenger." He was also the author of "The Depth of the Sea," and of numerous contributions to scientific periodicals. Our portrait is from the London *Graphic*.

RECENT INVENTIONS.

An improved hub for vehicle wheels has been patented by Mr. James Newmon, of White Oak, Ala. This hub insures wheels superior in durability, strength, and facility of manufacture and repairs. This wheel has its hub formed of the threaded tube provided with an annular flange, the tapering nuts having concave inner ends, and the ring plates provided with beveled annular projections and clamped to the spokes by bolts.

A novel power indicator and recorder has been patented by Mr. George Wale, of Paterson, N. J. The object of this invention is to obtain constant indication and permanent record of power taken from main driving shafts. This is an ingenious combination of mechanism in which a graduated dial is revolved by friction connections, and is controlled by a varying pressure.

Mr. Isaac Van Zandt Jones, of Salado, Texas, has patented a simple and convenient press for baling cotton, hay, tobacco, and pressing other materials. The invention consists in a combination of right and left hand screws with a peculiarly constructed toggle joint, the object being to increase the power of the press as the compression progresses.

Mr. John George Fischer, of Flemingsburg, Ky., has patented an improved adding machine. As many columns as may be desired, provided the sum of each one does not exceed one thousand, may be added by this device, and the work be done with great rapidity and correctness.

An improved combined hay tedder and rake has been patented by Mr. Will R. Johns, of Rockford, Ill. The object of this invention is to simplify the construction of hay tedders and rakes, and lessen the cost of their manufacture and reduce the friction and resistance so that they may be drawn by single horse.

Mr. Josiah N. McConnell, of Lawrence, Kan., has patented an improved flour bolt. The object of this invention is to increase the efficiency of flour bolts, economize space, and lessen the cost of construction. The end frames of the bolt are made of gas pipes connected by screw couplings, and are designed to be so made that they can be separated easily. They are connected at the top and sides and at the bottom of the first conveyer by boards secured to them by joint bolts or by rods running the whole length of the bolt. The boards form a base for the doors and a support for the hopper boards. The bolt is thus made in two or more separable sections, so that it can be readily taken through the door or window of the mill, allowing the bolt to be put together at the manufactory and shipped ready for use.

Mr. Erastus B. Barker, of New York city, has patented an improved photographic plate holder constructed with slide apertures or slots both at the sides and ends, whereby a slide may be inserted either at the side or end of the plate holder as desired. The holder has a novel arrangement of the cut-offs and the slides, the cut offs serving to guide the slides. This invention is equally applicable to both single and double plate holders. The same inventor has patented a camera box and sliding support provided with adjusting attachments, whereby the camera box may be conveniently changed from a horizontal to a vertical position, and *vice versa*, without disturbing the position of the sliding support or the focusing screws, and without removing the under frame of the support from the tripod.

Mr. William C. Seaton, of Quebec, Quebec, Canada, has patented an improved signaling apparatus for preventing the occurrence of collisions at sea, and to otherwise decrease the dangers incident to navigation by the use and application of a signal code and apparatus, by means of which a vessel may indicate her course, point of sailing, condition—whether in stays or hove to—course designed to be pursued, etc., and may direct an approaching vessel what course to pursue, may clearly indicate starboard and port sides of the vessel, and may communicate other necessary information, and by means of which lighthouses may be unmistakably identified, whereby a frequent cause of disaster to vessels is removed. The invention consists of a lantern provided with suitable lenses and with novel mechanical devices for producing flash signals of any desired combinations, duration, and frequency, mechanism for indicating inboard the number or character of the signals, mechanism for regulating the time or speed of the signals, and other novel mechanical combinations; and it consists, further, and in combination therewith, of lanterns for exhibiting fixed colored lights, and provided with novel devices for displaying and eclipsing the lights and for indicating their character inboard. There is a device for distinguishing the port from the starboard side of a vessel; and devices for signaling with the flash and fixed lights in two separate lanterns or in one lantern. The inventor provides a signal code based upon and interpretable only by means of the combinations of these signals, intended for the use of sailing vessels, steamers, and lighthouses.

BOILING POINT OF ZINC.—The author's experiments, several times repeated, show a temperature of 930°.—*J. Violle.*

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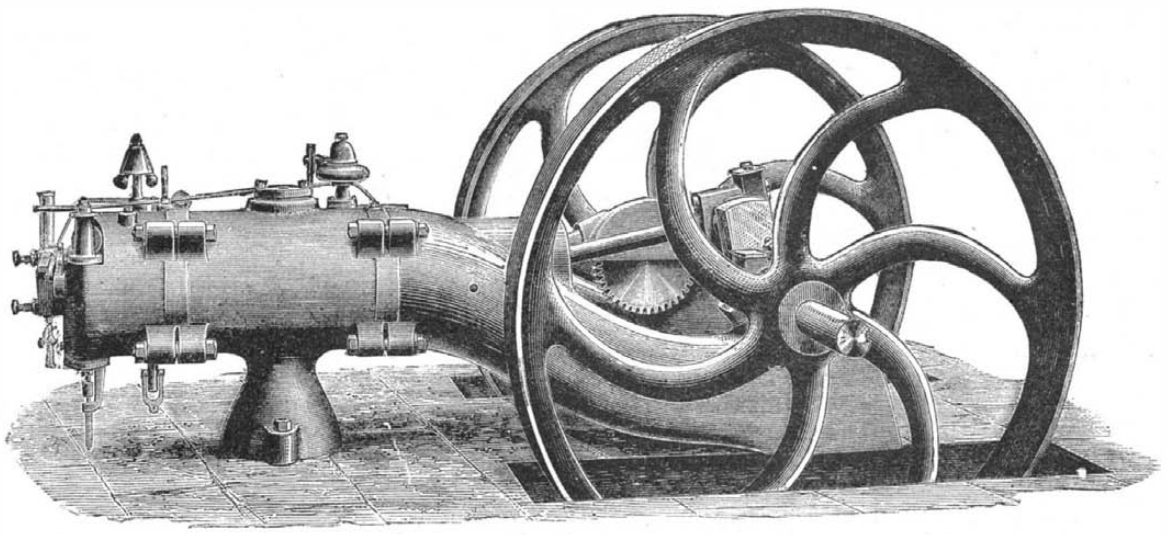
IMPROVED GAS ENGINE.

At the Electrical Exhibition, Crystal Palace, London, there are eight Crossley engines, namely, one 16-horse power nominal gas engine, indicating 40-horse power; three 12-horse power nominal gas engines, of 25-horse power each, indicating 75-horse power; one 8-horse power nominal gas engine, indicating about 15-horse power; one 3·5-horse power nominal gas engine, indicating 5·8-horse power; one 2-horse power nominal gas engine, indicating 3·9-horse power; one half-horse power nominal gas engine, indicating 2-horse power. The total indicated horse power is 141·7. The brake or effective horse power of these engines, when in good order, is stated to be about five-sixths of the indicated power. The 16-horse power engine is an entirely novel design, so far as the framing is concerned. We illustrate it herewith. The form is at once rigid, and most economical of material, while nothing can be easier to fix, nor depend less on the skill of the erector. This engine has also a new form of governor, in which, by changing the position of a link against the end of which a cam presses, the gas supply is varied by changing the period of admission. The air supply is nevertheless unaffected. This is a desideratum in Crossley engines. The principle of this new movement, which is simplicity itself, and yet is equal to varying the cut-off in steam engines, is also applicable to steam engines. If applied to them a separate small steam valve is put outside the slide casing, and on it the governor may operate in a manner analogous to that in which it operates on the gas valve. It is a form of governor arrangement which has the important advantage of offering no appreciable resistance to the governor itself, the work of moving the valve being done independently by the shaft of the engine.



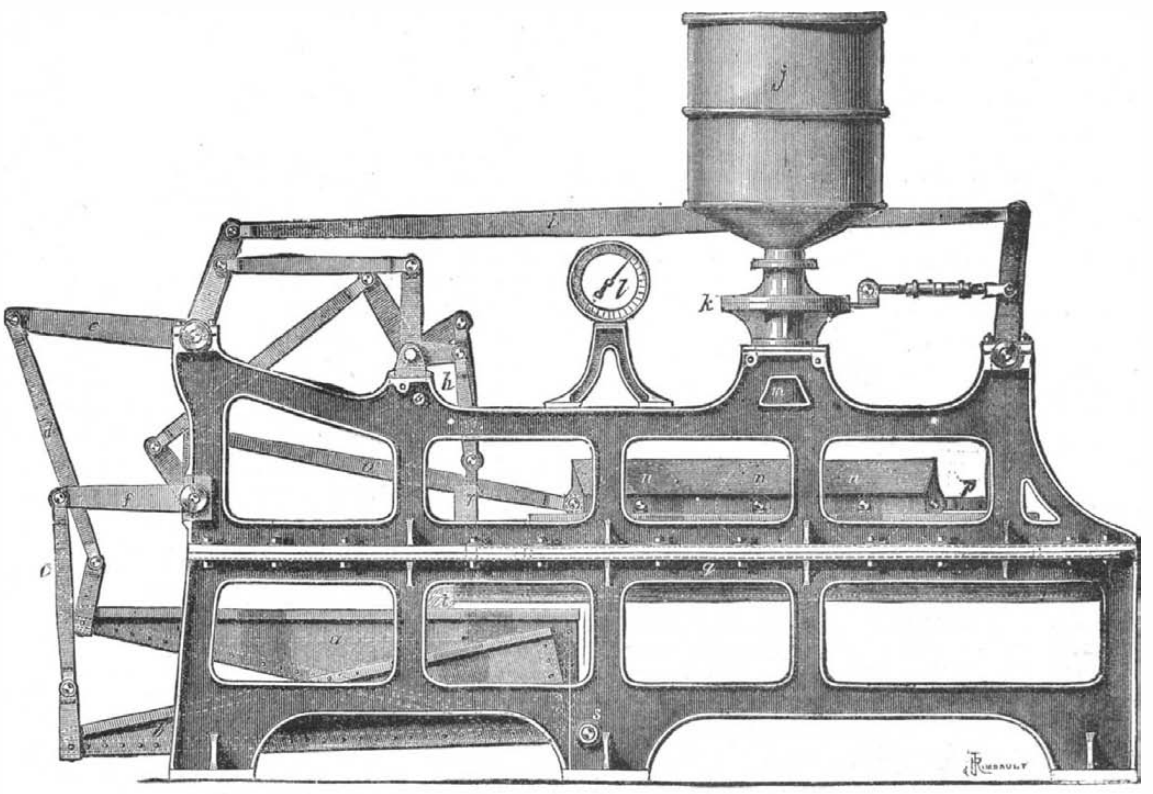
SIXTEEN HORSE POWER GAS ENGINE.

Everything about this engine is thoroughly substantial, durable, accessible, and, for the most part, even elegant in form. A small half-horse power nominal engine, which drives a number of Swan lamps, with a Siemens dynamo affixed to it on a suitable stand, forms a complete little electric plant, adapted for use in private houses, and is, we think, a very good little apparatus, and entirely novel, too, as a small installation.—*The Engineer.*

SEWAGE MACHINE.

The question of the purification and disposal of sewage has been tackled by a large number of engineers, chemists, and others, with a greater or less degree of success—more frequently less than greater. Mr. John Hanson's treatment consists in the use of lime and black ash waste as purifiers, and his system has been in use at Tong, near Bradford, England, for about four years with every success. It is also in use at other places, notably at Golcar, near Huddersfield, where the works were designed by Mr. Hanson and were started near the close of last year. The objection to lime alone, as stated by Mr. Hanson, is that lime alone does not remove the germs of infection, whereas with the addition of black ash waste the water is so effectually purified that, according to a report of the constable of the Tweed Commissioners, salmon fry and other delicate fish can live in the purified water. This black ash waste is a by-product from alkali works. According to Prof. Roscoe, for every ton of soda ash produced, from 1½ to 2 tons of waste are formed and accumulates in enormous quantities. This waste contains the whole of the sulphur burnt in the pyrites kiln, amounting to from 15 to 20 per cent of the weight of the waste. The purifying properties of black ash waste are as follows: Black ash waste as it comes out of the vat contains all the sulphur which was used in the making of the soda ash. It is then in the form of insoluble monosulphide of calcium. When the monosulphide of calcium is exposed to the action of the atmosphere it passes into a state of higher oxidation, then called disulphide of calcium. When this soluble disulphate of calcium is brought into contact with caustic lime, after both have been added to the sewage, then the disulphite of calcium contained in the black ash reacts upon the free caustic lime which is held in solution, and precipitates both in the form of monosulphide and sulphate, carrying down with them all the sewage impurities, thus discharging the effluent neutral and pure into the stream. By means of lime alone this is stated to be impossible. The two deodorizers are well stirred in the cistern by agitators, worked by a small gas engine. Into the lime cistern water is introduced to produce the necessary paste, and into the other the sewage runs by gravitation, and thus the effluent of each is a diluted fluid which is conducted into mixing and settling tanks. The tanks are emptied occasionally, the residuum being removed for use as a manure.

The chief feature of the machine, says *Iron,* is that it is worked by the sewage which is to be subjected to treatment, thereby avoiding the expense of skilled labor and fuel. Assuming the main sewer to be arrested, as it were, by this machine, its contents flow into a reservoir provided with a set of rollers which convert the lime and black ash to form the precipitate into a pulp. This is discharged into two trough levers beneath, which form the motive power for setting the whole machine in motion. A sufficient quantity of sewage having gone into one or the other of these troughs, it goes down, discharges its contents charged with the precipitating material, and in the action turns all the machinery that has ground the black ash and lime, and even registers the number of gallons of sewage that have passed. The invention is very simple. Every crank and lever is set in motion by one fall of the troughs, and it has not a wheel in it. Mr. Hanson calculates that for £500 such a machine could be erected which would clear the sewage of a town of 10,000 inhabitants. Of course, the great idea of treating sewage is to introduce the precipitating elements, to make it, in fact, innocuous; but this hitherto has only been effected at a great expense. Mr. Hanson's machine promises to make this a very simple matter.



MACHINE FOR PURIFYING SEWAGE.

Our engraving represents a side elevation of the apparatus. *a* and *b* are the water levers; when one is full of sewage water the lever drops and the empty lever rises, giving motive power to *c* and *d*, which are rods connected with levers *e* and *f*, and to the whole of the machine. The rods, *g* and *h*, are connected to sluices from which flow alternately the sewage water, Nos. 1 and 2, *a* and *b*. There is a lever bar, *i*, working the back part of the machine. The hopper, *j*, contains the black ash waste and lime or other chemicals for purifying purposes. A slide, *k*, is regulated to supply from *j* the given quantity of chemicals required to purify the quantity of sewage water contained in *a* or *b*. An indicator, *l*, is for registering the number of gallons of sewage water that pass through the machine. The chemicals fall through the tube, *m*, among the grinding rollers, *n*, by which they are crushed. The rollers are pulled forward by a lever, *o*, and backward by the lever, *p*. A sewage pipe, *q*, conducts the foul water to the sluice valves, *r*. The water levers, *a* and *b*, turn on a fulcrum rod, *s*. At *t* is seen the sewage water falling into the water levers.

It will, no doubt, occur to some that as the sewage is purer at night than during the day, the addition of the purifying material during the former period is so much waste. So thought Mr. Hanson, and he has devised an automatic arrangement whereby, as the sewage becomes purer, so the supply of purifying material is cut off until it ceases entirely. As the sewage becomes gradually foul in the morning the supply of the chemicals commences and continues. The mixture of sewage and chemicals will be led from the water levers into a series of settling tanks.

Lutorcine.

This compound is described in a sealed paper which the authors deposited in 1875, and which has now been opened at their request. Lutorcine is obtained on treating monobromated paracresylol with potassa. It crystallizes in very small colorless needles arranged in hemispheric masses. It melts at 104° to 105°, and dissolves easily in water, alcohol, and ether, but less readily in benzol and chloroform. It differs from orcine by its crystallization, its melting point, and its colored reactions. In presence of alkalies, lutorcine, on exposure to the air, takes a blood-red tint; acids turn this color to a yellow, but alkalies restore it. Chloride of lime gives a very intense and stable blood-red; potassium permanganate colors it also a bright red. With ferric chloride it takes a deep dirty green, and gives a reddish brown precipitate which does not contain iron. If treated with ammonia in presence of air it is converted into lutorceine, which has a brownish-yellow color, and is turned by acids to a pure yellow. This lutorceine dyes yellow.—*G. Vogt and A. Henninger.*

ENGINEERING INVENTIONS.

Mr. Henry A. Sessions, of Palestine, Tex., has patented an improved hand car in which the arrangement of the cranks and levers is such that the maximum amount of the power exerted upon the levers by the operators will be applied to the propulsion of the car, in other words, the object is to overcome largely the loss of power incident, through indirect action of the levers and unnecessary friction, to the common construction of car.

Mr. Thomas C. Steward, of Chattanooga, Tenn., has patented an improved car coupling attachment which is simple, convenient, and permits of coupling cars by means of the ordinary link and draw-head without requiring the operator to enter between the cars and endanger his life. This invention is an improvement on the car coupling attachment for which Letters Patent No. 236,855 were issued to the same inventor on the 18th day of January, 1881, and it consists of a bar or lever provided with an adjustable handle and pivoted to a collar loosely mounted on one end of a J-shaped bar attached to the end of the car, this bar being of such length that it can catch under the link of a draw-head and lift the link, so that it can enter the draw-head of the next car.

Mr. Henry Roth, of New York city, has patented a novel self-lubricating car axle box in which the concave or friction surface of the brass and the journal upon which the brass rests will be kept lubricated so long as there is any lubricant in the journal box. This end is accomplished by a peculiar arrangement of capillary conductors which constantly draw up and deliver to the journal the required amount of lubricant. The same inventor has patented a device for preventing the lubricant from escaping from the journal boxes, and preventing dust from entering them, also to facilitate the insertion of the lubricant.

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The Organization and Expense of a Force to Lay One Mile of Track a Day.

BY W. M. JOHNSON, TEMPLE, BELL COUNTY, TEXAS.

As an example to some one who may wish to engage in track laying, where one mile a day is required, I will give the figures from actual experience now in use.

THE ORGANIZATION.

The tie wrestlers: 1 panel spacer, 1 tie surfacer, 2 tie liners, 3 unloaders, 6 tie spreaders—13 men and a water boy.

The iron gang: 1 gauger, 2 heelers, 2 unloaders, 6 iron men—11 men and a water boy.

The front gang: 1 tie spacer, 1 spike peddler, 2 nippers, 4 spikers, 5 strappers—13 men and a water boy.

The tie loaders: 16 men, in 4 gangs of 4 each, and a water boy.

The back spikers: 1 tie spacer, 2 spike peddlers, 4 nippers, 8 spikers—15 men and a water boy.

The lining gang: 5 men and a water boy.

The back fillers: 15 men and a water boy.

Besides the above there is a man on the tool car to take care of and repair the picks, shovels, mauls, etc.

Making a total of 89 men, 7 foremen, 8 water boys, and 18 teams, viz: 16 hauling ties, 1 pulling the iron car, and 1 hauling water to the boarding train.

At the teamsters' camp there is also a camp boss, who takes care of the forage, harness, etc., a blacksmith, and a night watch.

Also, there is a superintendent of track laying, a general manager for the contractors, a bookkeeper, and a night watch at the boarding train.

Expense each working day:

1 superintendent or manager		$5.00
1 bookkeeper		4.00
7 foremen,	@ $3.00	21.00
4 men,	@ 2.25	9.00
24 men,	@ 2.00	48.00
18 teamsters,	@ 1.80	32.40
65 men,	@ 1.50	97.50
8 water boys,	@ 1.25	10.00
Feeding 40 mules		15.00
Fuel and wages on train		24.00
10 per cent for wear and tear		26.60
Total		$292.50

The 24 men at $2 each include the 11 iron men, 12 spikers, and the tool man.

The 4 men at $2.25 are the camp boss, the blacksmith, and the two night watches.

The teamsters get $30 per month and board.

The 7 foremen include the wagon master; and the 8 water boys include 1 for the teamsters; and supposing the amount paid by the men for board will balance the expense thereby incurred, no account is taken of the labor and store bill of the boarding train, but $3.50 per week per man will just *only* pay out.

WORKING THE ABOVE FORCE.

The panel spacer, with his 30 foot pole and pick, keeps far enough ahead to do duty as the road maker.

The 2 unloaders in the iron gang assist in loading the iron car, and while this is being laid they throw off from the flats another iron car load of 30 rails.

The front gangs of spikers (a pair on each rail) spike three ties in each panel, always the joint and the sixth and eleventh ties, skipping four ties each time.

Of the 5 strappers, 1 untrims the plates, leaving plates, nuts, and bolts on the joint tie, and the other 4, working 2 on a side, strap up and bolt the joints.

The tie loaders also unload the ties from the flats as fast as needed.

Should the back spikers get behind they are assisted by the front spikers whenever material runs short.

Should the back fillers get behind they can be re-enforced by the tie gangs, and the iron gang and strappers can put in the sidings.

The 16 teams have 14 loads of 12 ties each per day, making 2,688 ties.

THE MATERIAL TRAIN.

As the ties and steel are delivered to the track contractor at the last side track, and these are about 8 miles apart, the haul is never long to the front.

The train is made up of 10 cars of ties in the rear and 3 cars of steel in the front of the locomotive, or just enough material for a half-mile, and is at the boarding train at 6 o'clock A.M., in time to take the force to the front as soon as they breakfast.

The back fillers, liners, and back spikers are dropped where they stopped work, and the 10 cars of ties are left far enough back to give the train room to pull off the unloaded steel for the iron car to get at it.

The 10 cars of ties are moved up as fast as the track will allow, so as to make the haul as short as possible, and only enough are unloaded at each time to keep the wagons busy and prevent any delay.

At noon the train carries the force back to dinner, and the empty flats are side tracked, and another load of 10 cars of ties and 3 of steel brought up to the boarding train in time to take the men back after dinner.

The ties are loaded, generally, 135 to a car, or 20 cars to the mile; while the steel is loaded 60 bars to the car, or 6 cars to the mile.

In loading the iron car only 30 rails are put on each trip.

Only one train is used in this work; and where water may be scarce, a 100 barrel water car is added.

The hauling of all bridge, depot, tank, telegraph, and other material, is left to the trains that supply ties and steel to the contractor.

The track is not surfaced by this force; but enough material is put on the track to keep the ties squared and spaced.

The back spikers (2 gangs on a side) spike 6 ties each, instead of 3, as with the front spikers, and in this way seem to do double duty; but, as they are not detained by the movements of the train, or the iron car, they accomplish it.

A push car accompanies them to pick up all loose spikes, nuts, bolts, etc., thus requiring 2 spike peddlers.

As the front spikers spiked the first (joint), sixth, and eleventh tie in each rail, there are 12 ties left for the back spikers, the front pair spike the third, fifth, eighth, tenth, thirteenth, and fifteenth ties, leaving as many more for the other pair.

The teamsters' camp is moved up every Sunday to some suitable place about four miles beyond the end of a track.

The force as above organized can lay 1½ miles steel per day, but cannot keep up the back work and lay much over 1 mile.

GENERAL REMARKS.

We are laying 50-lb. steel rail, square and supported joints, fish plates, no nut locks, ties all full spiked, 15 to the 30 ft. rail, spaced 2 ft. centers, square to the track, laid to a line on the right hand side.—*Engineering News.*

McDermott's Pantaloons Protector.

We give an engraving of a novel pantaloons protector, which has been patented by Mr. Chas. J. McDermott, of Sandy Hook, Conn. This invention consists of a spring provided with a rubber ball at its upper end, and attached to the heels of boots and shoes (especially rubbers and other overshoes) for holding up the bottoms of the wearer's pantaloons and protecting them from mud, etc. This simple device is entirely out of the way when not in use, and when in use the bottoms of the legs of the pantaloons are placed between the rubber ball and the shoe, holding them securely out of the mud, snow, or slush.

Stripping a Negative Film from the Plate.

Herren Meyer and Gaillard lately described to the Berlin Photo Association the following process, which they always found successful: The plate should have no substratum which makes the film adhere, therefore, above all, there should be no albumen substratum; it is rather necessary to prepare the plate so that the film shall sit loose to it. When plate glass is used, rubbing with talc is sufficient; with other sorts of glass a substratum of caoutchouc, prepared rather stronger than usually used for negatives, does good service. They expressly remarked that the widespread notion that substratum makes the film adhere more firmly to the plate was erroneous. The finished negative should not be gummed, and, of course, not varnished. When dry lay it down horizontally and pour over it the gelatine mixture hereafter described. Leave it to dry in some place free from draughts. Run a knife round the edges of the film, and, as a rule, it may then be drawn off flat. The gelatine mixture consists of one part of gelatine to ten parts of water. More gelatine may be used, but then the film must be poured thinner. In order that the gelatine may not become brittle (which would be apt to cause rents and cracks) add a little glycerine, but not too much, otherwise the film will be difficult to dry, and it will remain tacky for a long time after. Unfortunately the amount of the addition of glycerine to be added cannot be given precisely, as it varies with the state of the atmosphere, the brittleness, and the relative quantity of the gelatine. Herr Meyer found that when the air was extremely dry the plate must be taken into a damp place before stripping it off, as, in spite of a proportionately large quantity of glycerine, the film would still be brittle. Fifteen parts of gelatine to one hundred of dry gelatine was suggested as a medium amount.

Herr Fähling gave the following formula for the gelatine: Gelatine, 10 grammes; water, 100 grammes; alcohol, 20 grammes; glycerine, 1·5 to 2 grammes; glacial acetic acid, 1 gramme.

Herr Gaillard mentioned another method which had been recommended to him, but which he had not yet tried: A smooth sheet of gelatine is laid damp upon the moistened plate; the squeegee is passed over, and when dry the negative is stripped off.

The Prickly Pear as an Antelope Fence.

The prickly pear, that ugly, fleshy little cactus, with its sudden summer glories of crimson and golden blossoms, fulfills a strange purpose in the animal economy of the prairies. In itself it appears to be one of the veriest outcasts among vegetables, execrated by man and refused as food by beast. Yet if it were not for this plant the herds of prairie antelope would have fared badly enough. For the antelope, whenever they found themselves in straits from wolves or from dogs, made straight for the prickly pear patches and belts, and there, standing right out on the barren, open plain, defied their swift but tender footed pursuers to come near them. For the small, thick pads of the cactus, though they lie so flat and insignificantly upon the ground, are studded with tufts of strong, fierce spines, and woe to the wolf or the dog that treads upon them. The antelope's hoofs, however, are proof against the spines, and one leap across the belt suffices to place the horned folk in safety. These patches and belts, then, so trivial to the eye and in some places almost invisible to the cursory glance, are in reality towers of refuge to the great edible division of the wild prairie nations, and as unpassable to the eaters as was that girdle of fire and steel which Von Moltke buckled so close round the city of the Napoleons.—*World.*

Action of Acid Solutions upon Stannous Oxide.

Stannous hydrate may lose its water and become transformed into crystals of the anhydrous oxide under circumstances which are complex and imperfectly known. The crystallization may occur either in acid or alkaline liquids. The author examines the first case in detail, and shows that with reference to oxide of tin the acids may be divided into two groups. Those of the one group give, with this oxide, salts which are entirely decomposed by boiling water, and determine its transformation into the crystalline oxide in consequence of successive reactions. These salts, decomposable by water, yield free acid, and behave absolutely like the acids themselves, determining the crystallization of stannous oxide. The acids of the second class do not give rise to these successive reactions, and the hydrated stannous oxide never becomes anhydrous and crystalline under their influence.—*A. Ditte.*

Improvement in Steel Manufacture.

A promising test was recently made of the Griffith low-pressure fixed vertical converter in the presence of a number of prominent English iron and tin-plate manufacturers. Blows were made with a maximum blast pillar of 4½ lb. per square inch, each blow taking an average of twenty minutes. The yields were good, and the steel produced of excellent quality, soft and ductile, suitable for merchant bars or tin plates. Some of the steel was worked and welded during the test. No spiegeleisen was used, the only addition being 1 per cent. of ferro-manganese. The advantages claimed for the process are its simplicity and small cost of plant, and that no skilled labor is required to work it. It can be worked by an ordinary blowing-engine giving a maximum blast pressure of 5 lb. per square inch. A 2-ton converter, working ten hours per day, will make 120 tons of soft steel per week; the cost of such converter, under favorable circumstances, being about $1,250, thus placing a steel-making plant in the hands of small manufacturers. These converters can be increased in size and worked in duplicate to any extent. An important point in this converter is that it can be worked with four or six tuyeres fixed horizontally. By a simple mechanical arrangement, a stopper or plug in each tuyere is actuated by steam or air, and shuts the tuyere at the proper time. There is also a slag hole, which runs the cinder off during the early stage of the blow, relieving the metal of some of its impurities, thus reducing the time in operation to a minimum. The dephosphorizing process may also be applied to this method, which the inventor thinks is likely to take the place of the more costly plants, and eventually do away with the wasteful and laborious puddling process.

Cable Connection with Germany.

The new cable connecting Emden with the Anglo-American cable system at Valentia, and completing direct cable connection between Germany and the United States, was inaugurated April 22. The first direct cable message transmitted from Germany to the United States was from the German Emperor to President Arthur, sending greetings and congratulations upon the completion of the work. President Arthur appropriately replied.

Fishing in a Cornfield.

In Colorado is a ten-acre field, which is no more nor less than a subterranean lake covered with soil about eighteen inches deep. On the soil is cultivated a field of corn, which produces thirty bushels to the acre. If any one will take the trouble to dig a hole to the depth of a spade-handle he will find it to fill with water, and by using a hook and line fish four or five inches long may be caught. The fish have neither scales nor eyes, and are perch-like in shape. The ground is a black marl in nature, and in all probability was at one time an open body of water, on which accumulated vegetable matter, which has been increased from time to time until now it has a crust sufficiently strong and rich to produce fine corn, although it has to be cultivated by hand, as it is not strong enough to bear the weight of a horse. While harvesting the hands catch great strings of fish by making a hole through the earth. A person rising on his heel and coming down suddenly can see the growing corn shake all around him. Any one having sufficient strength to drive a rail through the crust will find on releasing it that it will disappear altogether.—*Territorial Enterprise.*

FOURTH TIME AS MAYOR.—Mr. Daniel F. Beatty, the well known enterprising piano and organ maker of Washington, N. J., is now rejoicing in the just pride of his election as mayor of that city for the fourth time.

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An Ancient Grecian Cuirass.

One of the most interesting specimens of archaic Greek art in existence has been brought to light by Mr. Stillman, and is now exciting the keenest interest in the archæological circles of Athens. This treasure is the back of an elaborately wrought bronze cuirass, and is thought to be at least as old as the sixth century before Christ. There are seven subjects engraved on it, which are thus described: The main subject, which occupies the lower part of the cuirass, consists of two groups of three figures each, each six inches high, and it has been diversely interpreted to represent either the reconciliation of Apollo and Hermes or a king consulting Apollo. On the one side is Apollo playing on the lyre, attended by Lato and Artemis, and on the other a royal or divine figure, followed by two attendants. The personages are dressed in the most elaborate costume, and every detail is rendered with finished skill, the patterns even of the stuffs of their various garments being delineated with the utmost precision. The subordinate personages are barefooted, but Apollo wears a pair of sandals, and the other principal figure high peaked boots, such as are worn to the present day by the Epirotes. Above this row of figures, running across the lower part of the cuirass, there is on each of the clavicles a bull, and above the bull a lion, each facing his counterpart on the other clavicle. Between them are two leopards, rampant, supporting each other, surmounted by two sphinxes, also rampant and in the same attitude. Each of these subjects is framed in rich ornamental borderings of different patterns, that which runs along the lower edge of the cuirass under the chief design being especially quaint and elaborate. This unique art treasure was found some twenty years ago in the Alpheus by a fisherman, who caught it in his net and sold it as old metal at a shop in Zante, where it lay buried among a mass of worthless lumber until Mr. Stillman's critical eye discerned its value and rescued it from oblivion. It has been placed in the museum at Athens. —*N. Y. Tribune.*

Digitated Stockings.

From time immemorial stockings with toes have been used occasionally, particularly in the treatment of certain foot troubles. Lately they have come into more general use, and not a little public discussion has arisen over the fashionable novelty. The London medical authority, *Lancet*, is strongly inclined to favor them as likely to conduce to comfort, and spare many persons who now suffer from the development of soft corns between the toes, a serious trouble. "They would also be more cleanly than the stockings in common use, because they would naturally absorb and remove the acrid moisture which accumulates between the toes, and which is the general cause of offensive odors from the feet. They will, moreover, give the foot better play, allowing its phalanges greater freedom of action. And, lastly, a well-fitted digitated sock or stocking will remove a mass of material from the toe of the boot, and, at the same time, secure increased breadth and space for expansion across the base of the toes. The new stockings, supposing them to be well cut and fitted, possess many advantages."

Even if the toed stocking should have no other effect than to expel the ugly and unphysiological "French-toed" boot, it would prove a public benefit.

How the Manufacturer Helps the Farmer.

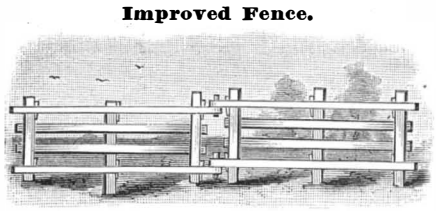
The national advantage of broadly diversified industries, and the local advantages to farmers and manufacturers arising from their close proximity, were set forth with rare directness and cogency by the Hon. Charles M. Shelley, of Alabama, in a recent speech in the House of Representatives, in the course of which he said:

A community which is blessed with these diversified industrial enterprises acquires wealth rapidly, and the temporary failure of one branch of industry does not bring that distress and suffering that comes from failure when you depend entirely upon a single industry, such as agriculture. The agriculturist who has a manufacturer for a neighbor is encouraged to grow every variety of crop that the soil is capable of producing. A market is found at his door for his product, and as these neighbors are multiplied the demand for his products is increased. This increased demand stimulates the price, which reacts upon the farmer, who improves and stimulates his land to increased production, and so on, each acting upon the other, until the highest productive capacity is reached in both agriculture and manufacturing. The farmer may have to pay higher prices for his goods, but he is able to do so because he sells his own products for higher prices and has more to sell. A large proportion of the products of the farm will not bear transportation to a distant market. These products, which in many instances could be grown without any additional cost to the farmer, would not be grown if they could not be sold at their doors.

To show the full force of this point I call attention to the condition of the farming class in Pennsylvania and contrast it with the farming class in Alabama. In Pennsylvania, where the manufacturing interests have reached a high degree of development, the farmers are thrifty and well-to-do. Every year they make a support and something over, which surplus is invested in the stocks of these manufacturing enterprises, from which they draw regular dividends, and thus become to a large extent the beneficiaries of this very system of protection which the free trader (assuming to speak for the farmer) denounces in such strong language. The profits of the factory added to the profits of the farm grow from year to year, until the poor farmer, whose pitiable condition is so pathetically portrayed by the anti-tariff politician, rejoices in the accumulation of a substantial fortune, and his little farm of twenty, forty, or one hundred acres becomes the source of a princely income. The lands upon which these fortunes are made are valued by their owners at an average price of about fifty dollars per acre.

These are the results upon communities who were prepared to avail themselves of the advantages of a protective tariff. Now turn to an agricultural country such as the southern and central portion of Alabama, and see the condition of things there. The farmers there devote most of their energies to the growth of cotton, because it bears the cost of transportation better than anything else they can raise, and if the season should happen to be unpropitious and the cotton crop fail, the whole people are reduced to a state of distress and poverty. A partial failure of the crop in Alabama last year has been most disastrous. Many farmers are not able to buy seed to plant their lands. The price of lands in Alabama averages about four dollars per acre. This condition of things would not exist if Alabama, like Pennsylvania, had a factory of some kind in every community.

Improved Fence.



The engraving shows a novel fence lately patented by Mr. Levi McNall, of Allegany, N. Y. It is an improvement in self-supporting wooden fences, and requires no posts set in the earth. The independent panels are connected so that they may be readily detached one from the other. Each panel is composed of three vertical parallel posts, two longitudinal rails, one at the top and the other at the bottom, and two boards attached to the posts between the rails.

The rails are made sufficiently thick to insure the strength and rigidity of the panels, and have three mortises for receiving the posts which are secured in the mortises by means of wedges. The panels are set zigzag, like a rail fence, and the ends are secured together by pins passing through holes in the projecting ends of the top and bottom rails of each panel. It will be seen that this fence is entirely self-supporting, and that the expense and trouble of digging post holes are entirely avoided.

Strikes.—Their Cause and Effect.

The labor disturbances which are rife in many sections of the country present a problem most difficult of solution, and one which bids fair to disturb the prosperity with which two seasons of activity in business, and a third in immediate prospect, had been viewed with promise and satisfaction by all classes. The labor disturbances in 1876–7 had for their basis exactly opposite causes from those which now prevail. Then all business was unsettled, and labor clamored for hire more than for increased compensation; the contest was more a battle of the outs who could not find work to do, than of the employed, who were in a measure compelled, through the influence of pernicious trade organizations, to side with the vast army of unemployed, which filled the country with restless tramps. The revival of business consequent upon the resumption of specie payment, gave employment to those who were suffering from enforced idleness, and, as if by magic, not only the army of tramps disappeared, but the content resulting from an ability to procure wages to keep one from starvation became the general rule.

In the strikes and disturbances of five years ago was found a most thorough confirmation of the truth of the old adage, "The devil finds some mischief still for idle hands to do." The labor disturbances of the present time arise from an exactly opposite cause, and yet, from causes which led to the state of things which precipitated the direful days of depression, and subsequent want of employment. Now, plenty of work is offered to the willing worker, and the compensation offered is such as would in days anterior to the war, and the speculative times which followed, have been considered munificent. Why, then, are they now looked upon as grinding and insufficient? Provisions and wearing apparel are in the main as cheap as they were when good mechanics were not only content, but found means for acquiring a competency upon much smaller wages than they can now command. But the war taught the use of luxuries to those who had hitherto been content with the necessaries of life, and the workers of to-day are largely the children of the period previous to the panic of 1873, and were then made accustomed to hearing higher wages and compensations spoken of as the normal condition and right of the toiler. The tastes then acquired still cling to them, and they cannot understand why the man who could then command $4 a day should now be compelled to do the same service for $2. The circumstances under which the higher compensation was paid, culminating, as they inevitably must, in disastrous panic and general distress, are forgotten, and are appreciated only by a small minority of such as were in the ranks of labor twenty years or more ago. But few of these latter will be found among the striking classes of to-day, for they remember that if the compensation was smaller, the cost of living was also much less, and that more money was saved against a rainy day by the laboring classes, as a rule, than was saved during the era of high wages and more than corresponding expenses.

One of the largest manufacturing houses of the Northwest bought, during the war period, a large tract of land convenient to its works, and, laying it out in lots of suitable size, encouraged its employes to become the owners of their own houses by paying a small amount each week from their wages, the employers assisting such as so desired, to erect a suitable cottage. Ten years later, and after the panic of 1873 had been most severely realized, the principal man of the firm asserted that in no instance had an employe whose compensation in the good times had been as much as $5 per day, paid for his place, while no man working at from $2 to $3 per day had failed to obtain his deed and become the rightful possessor of his home.

Here, then, is food for serious thought, and the only conclusion to be arrived at is that moderate wages induce economy, while high compensations induce extravagant tastes and expensive habits. It is not so much what a man earns as what he saves that counts for wealth and leads to prosperity. The strike among the mill and boom operatives at Muskegon has for its ostensible object a reduction in the hours of labor rather than in an increase in compensation, yet an analysis of the situation develops the fact that to cut down the hours of labor will, in a measure, deprive the mill owners and boom companies of the ability to pay the same rate of wages which they can now afford to pay for ten hours' work, or will so raise the cost of lumber to the consumer as to bring hardship and deprivation upon quite as many, and probably more, persons than would be benefited by the reduction. It is true that work about logs and lumber, whether in the woods, at the boom, or in the sawmill is extraordinarily laborious, and a man can readily tire his muscles with ten hours' work to a condition where rest is grateful. Yet the great masses of dwellers in cities are doing as hard, or more exacting, work for less compensation. There are to-day thousands of young men in Chicago wearing themselves out in clerkships, laboring from 7 o'clock in the morning until 6, or, in many cases, 10 o'clock at night, for scarcely more compensation than will, with economy, pay for their board and clothing, while their occupations are steadily undermining their health and unfitting them for the useful and successful futures toward which each one is looking with longing eyes.

There are thousands of young girls in this city who end up their day's work with an exhaustion the sturdy logger or mill hand never dreams of, and for a compensation of from 50 cents to $1 per day at that.

These must yield to the exactions of dress and appearance in order to gain even this miserable pittance. Thousands of working women are to be found not only in Chicago but in all other large cities, who esteem themselves fortunate if they can average $3 per week for the support of themselves and their little ones, while the exactions for rent and other needful expenses leave them but the plainest food, and the smallest quantity at that. The hard-working muscle of the logger and the mill hand may be tired at night, but not so tired as the hard-worked brain of his employer, who knows no limit of hours to his toil in keeping in motion those influences which enable him to keep his men employed. To the sober and steady toiler at muscular and out-of-door occupations, "tired nature's sweet restorer—balmy sleep," comes as a healing balm, and the morning finds him ready to exert himself anew, while his employer rises from a couch of restlessness, tired out before his work begins. Wealth has its disadvantages, and poverty has its compensations. Hard work and a good appetite are far more to be coveted than wealth and a big doctor's bill. Fair wages and a cheap market, enabling one to live and lay by even a few cents per day, are more desirable than high rates of compensation and a necessitated expenditure equaling if not exceeding the income.

When wages were $4 per day calico was from 15 to 20 cents per yard, and if the manufacturers of cotton goods were now to respond to the demands of their employes for increased wages, wage-workers, as well as capitalists all over the land, must be called to pay the increase through the additional price of cotton goods. If by cotton goods we were confined to the single item of prints, our assertion might well be received with a sneer, for the use of prints in this country has vastly decreased, and one of the prominent causes of labor commotion is found in the fact that plain clothes, be they never so neat and pretty, are no longer tolerated. But the same principle holds good, whether it be in cotton or silk manufacture, and it will invariably be found that if wages increase, the actual measure of accumulating wealth to the fairly prosperous is less in proportion than it is under a system of smaller compensation, with resultant necessitation of economy, while the poverty of the poor is more grinding.

While we sympathize with the man who has hard work to do, and can but acknowledge in the main the justice of his assertion that ten hours is long enough, we can sympathize yet more with the wife who can with truth assert and sing from her heart the refrain:

> "Man's work is from sun to sun,
> But woman's work is never done.'

Yet we cannot but assert, as the teaching of experience, that he is not the happiest who works the least, and were the woman to assert her rights to shorter hours of labor as does her husband, he would soon find cogent arguments to prove that, at least for the woman, long hours of labor could not be dispensed with in the workingman's home any more than upon the farm of the agriculturist. If then, as a thinking

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man, each one of the strikers would become for the nonce a political economist, and, tracing cause and effect, give experience due credit in influencing his future course, strikes would be fewer and the employe would be surer of the steady wages which the prosperity of the employing classes would enable them to pay. As it is, a moment's reflection and a little figuring will enable him to come to the conclusion that if he gains his point, the value of the time lost, not to speak of the resultant demoralization to himself and family, will more than offset the advantages to be secured.—*N. W. Lumberman.*

IMPROVED BOILER AND FURNACE.

We give herewith an engraving of an improved steam boiler, patented by Mr. William Ord, of Brooklyn, Ohio. The body or main portion of this boiler is of the usual construction. The particular one illustrated is tubular, 12 feet long and 48 inches in diameter. The improvement consists in a water front of cast or malleable iron, which is fitted to the lower surface of the boiler and forms a support for its forward end. This water front is cast with integral stays at suitable intervals, and the inventor has taken great pains to avoid flat unsupported surfaces by making the water front externally convex between the stays and by providing strengthening ribs.

Two three-inch tubes enter the water front on each side of the door and enter the boiler at the rear end, one tube of each pair entering the boiler near the bottom of the water space, the other entering near the top. To guard against any possible injury by the unequal expansion of the tubes they are provided with swinging joints.

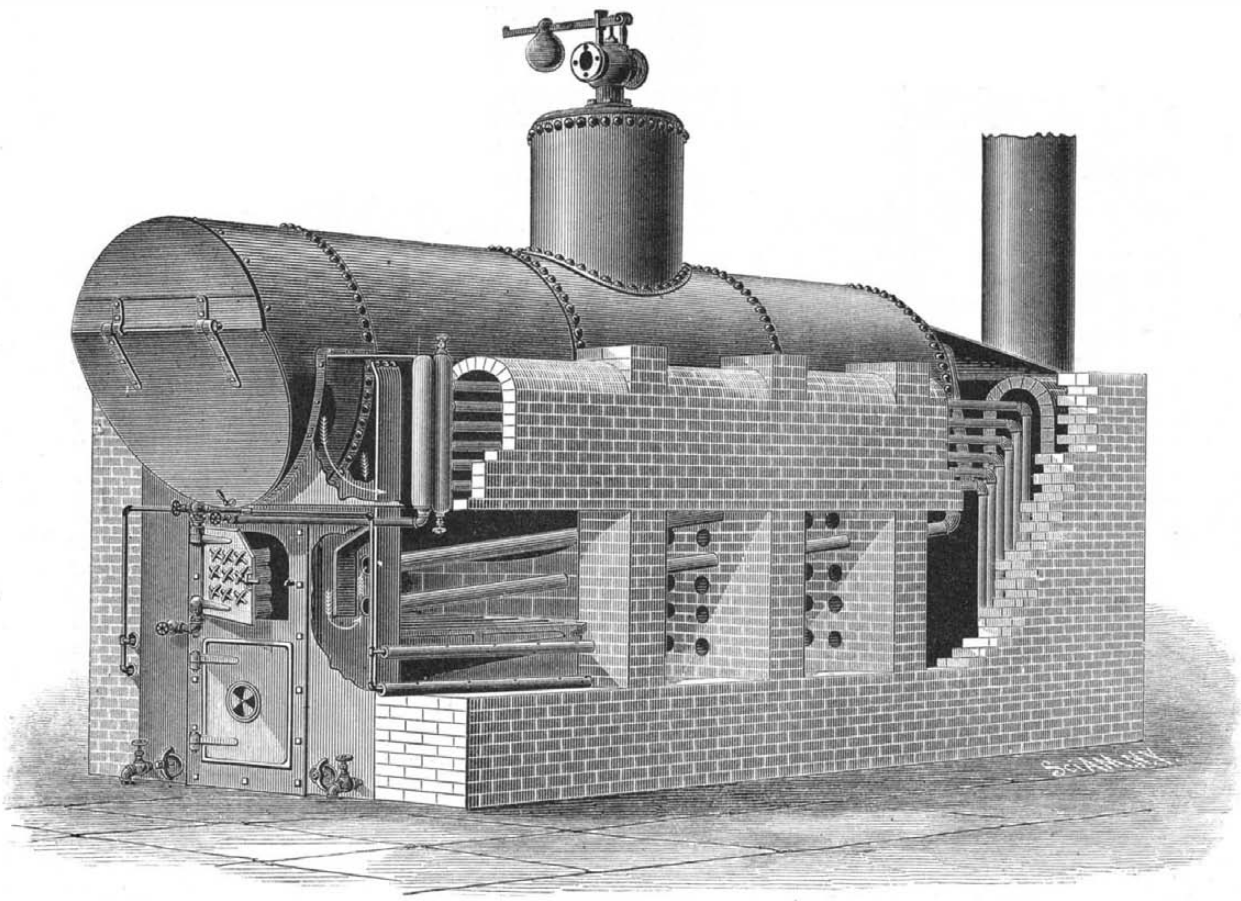
The water front is connected with the boiler directly as well as by means of the side tubes. The result of this construction is the deposit of all sediment in the lower part of the water front, where it is removed from the action of the fire. This relieves the boiler from deposits of sediment and improves its steaming qualities, besides greatly increasing its capacity without proportionally increasing the consumption of fuel.

The door of the furnace is chambered, and receives water through tubular hinges, adding still further to the capacity of the boiler and at the same time increasing the durability of the door.

The furnace between the grate and rear end is provided with a series of perforated walls, which are designed to retain heat and aid in the combustion of the gases that escape unconsumed from the fire. To facilitate this operation the inventor provides a series of hot-air pipes, and forces hot air into the furnace and between the heat-retaining walls. This results in a very perfect combustion and in the suppression of a great proportion of the waste due to the escape of unconsumed gases.

In a side flue, shown in the engraving, there is a feed water heater composed of a series of tubes connected by manifold and communicating with the feed pump and boiler. These tubes have a great capacity, and the water in passing slowly through them deposits much of its sedimentary matter. The heater is arranged with valves so that it may be employed whenever necessary. In the improved boiler the cost of the combined water front and mud drum is less than that of the usual cast iron front and mud drum. The heating surface is largely increased by the application of this improvement, and as the tendency of the water to lift is greatly decreased, the steam is furnished dry. These and other advantages will be acknowledged by steam engineers and others familiar with the requirements of a practical and economical boiler.

Further information may be obtained by addressing the Buckeye Bridge and Boiler Works, Cleveland, O., or the inventor as above.



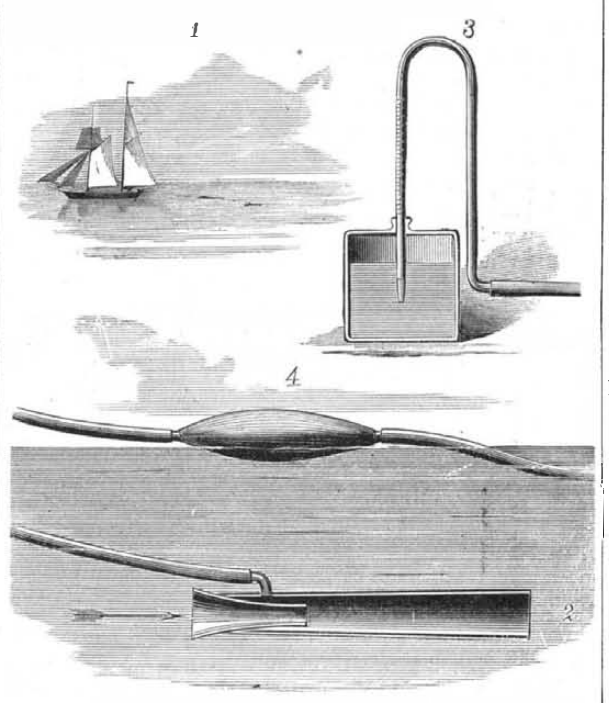
ORD'S IMPROVED BOILER AND FURNACE.

Cheap Oxygen.

Les Mondes states that the Boussingault process of obtaining oxygen by the alternate peroxidizing and reoxidizing of barium has been greatly improved in the hands of MM. Brin. Four hundred separate charges were taken off, yet failed in any way to deteriorate the mass. These manufacturers anticipate being able to supply the gas at about twelve to fifteen centimes per cubic meter. As this is something like ten or fifteen cubic feet for a cent, the realization of such anticipations would prove of the highest importance in the arts.

NOVEL SHIP'S LOG.

The engraving shows a novel device for readily and accurately determining the speed of a vessel moving through the water, regardless of the time, position of the vessel, or condition of the water. This is effected by means of a device for creating a vacuum in a pipe extending to such a distance from the vessel as to be outside of the body of water affected



IMPROVED SHIP'S LOG.

by the vessel's movements, yet communicating with an indicating device upon the vessel, so graduated as to show the extent of the vacuum, and consequently the speed at which the vessel is moving through the water.

The instrument consists essentially of a flexible pipe, an indicator or gauge upon the ship, with which one end of the pipe is connected, and a vacuum device of any suitable construction, connected to the opposite end of the pipe, towed after the ship, and constructed to permit the water to so flow past the end of the pipe as to create a partial vacuum in the latter.

Fig. 4 shows a tube open at both ends, the forward end being flaring, the better to catch the water as the tube is drawn forward. This tube is provided at the front end with a sleeve, forming a surrounding chamber, open at the rear end and communicating with a long flexible and non-extensible pipe, which at the opposite end communicates with a vacuum or other gauge, shown at Fig. 3, arranged in any desirable position upon the vessel. The flaring tube is so constructed and connected to the flexible pipe that the tube will be maintained in a substantially horizontal position, and floats are attached to it for this purpose.

As the tube is towed after the vessel and carried through the water the air or water is withdrawn from the flexible pipe to an extent proportioned to the speed of the vessel, thereby creating a partial vacuum in the pipe and in the gauge on the vessel, which indicates, by the position of the mercury or index finger of the gauge, the speed of the vessel. This invention was recently patented by Mr. William S. Hogg, of Washington, D. C.

The St. Gothard Parasite in India.

Professor J. F. P. McConnell announces that he has discovered in Calcutta the parasite *Dochmius duodenalis*, which caused so much trouble among the workmen of the St. Gothard Tunnel. Professor McConnell states that the worm is by no means confined to the upper division of the small intestines; on the contrary, the majority of the specimens were removed from the mucous membrane of the jejunum. They were firmly fixed to the gut. As Professor McConnell found the parasites in a large number of post-mortems, in cases where the victims, who are natives, died of many different diseases, he does not feel justified in stating that they were the sole cause of death in any case. In many patients he admits that anæmia was the prevailing feature, but attributes this rather to dysenteric and malarial complications.

Railway Progress in the Southwest.

The president of the Atlantic and Pacific Railway Company, Mr. H. C. Nutt, has lately returned from an inspection of the line in New Mexico and Arizona, and of the Atchison, Topeka, and Santa Fé Railroad. Mr. Nutt said (April 21) that the track laying had been completed to Cañon Diablo, 311 miles west of the Rio Grande. A viaduct is being built over the cañon 525 feet long and 254 feet high, to be completed by May 25, at a cost of $250,000. The track will be pushed west to the Colorado River, 250 miles, at the rate of two miles a day. One hundred miles of that distance is graded, and steel rails for 200 miles are delivered. Plans are just completed for a bridge across the Colorado River, to cost $250,000. He will also extend the Central Division 100 miles west from Vinita, Indian Territory.

NEW INVENTIONS.

An improved cyclometer has been patented by Mr. John J. Morton, of Albion, Mich. The object of this invention is to apply odometers to bicycles in an inexpensive and convenient manner, and so as to secure accuracy of operation without liability of derangement. Heretofore odometers have been applied to the axles of bicycles; but, the space being limited, it has been necessary to remove the lamp to make room. Further, the application has not been such as to secure accuracy nor render the instrument convenient for observation. This invention consists in an odometer suspended face upward by means of a weight or by the lamp, so that it can be freely observed by the rider.

Mr. Edmund T. Spottswood, of Perrysville, Ind., has patented a revolving sickle bar for mowing and reaping machines, the particular form, construction, and arrangement being such, relative to each other and to the fixed cutting edges, that the spiral edges, as the sickle bar revolves, travel across the fixed cutting edges continuously or in such rapid succession as to cause all the grain to be cut as effectually as with the ordinary reciprocating section bar or sickle.

Mr. Jared R. Woodfill, of Aurora, Mo., has patented certain improvements upon that form of repeating instrument in which the instrument for each line has a magnet with independent helices about the same core, one of which helices in each instrument is charged by their respective main line circuits, and the other of which helices is charged by a local battery current, and in which each instrument is provided with two sets of contacts controlled by the armature lever of that instrument, one of which set of contacts in the first instrument controls the second main circuit in the other instrument, and the other of which set of contacts in the first instrument controls the local battery in the second instrument, and in which the two sets of contacts of the second instrument act reciprocally to the first in the same way to produce the same result.

CAPT. LAMB, of the bark Elizabeth Ostle, from Calcutta, March 23, saw, the day before, in latitude 39° 30', another immense field of dead fish. For a distance of forty miles the dead fish were seen floating about. They appeared to be quite fresh, and looked like shad. Another ship, from Rio Janeiro, passed through a great multitude of dead fish, the same day, about sixty miles from Barnegat.

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SOME CURIOUS BUGS.

Everything is valuable in natural history; even the study of bugs is interesting in spite of the discredit thrown upon them by that horror of housekeepers and travelers, the bed-bug. The latter, however, is only one species of a large order of insects, the hemiptera, which are distributed over both the land and water, in Europe and America.

This order is characterized by an incomplete transformation; the only difference between the larvæ and the adults is their progressive development of wings and their smaller size. These are sucking insects, feeding both on animal and vegetable juices. They have a sharp, horny beak, curved along the breast when not in use, which contains, in a groove, delicate needle like bristles, and makes the punctures through which the insect sucks its food.

They have generally four wings, the upper two thick at the base and membranous at the ends, half elytra and half true wings, from which formation this order takes its name of hemiptera, meaning "half wings." In all species the lower wings are membranous, and in a few the upper wings are also; some others are wholly wingless, like the bed-bug. Most of these bugs emit a disagreeable odor.

In this order are found the tree hoppers, the harvest flies, and plant lice, which are so destructive to vegetation. Here belongs the well-known squash bug, whose odor is so disagreeable when it is handled.

In the genus *Lygorus* belongs the chinch bug that has caused so much damage to the fields of grain in the South and West. The white-winged species is about three-twentieths of an inch in length; its general color is black, with white wing covers, edged with black, and reddish yellow legs and beak. The young wingless ones are bright red.

Another species is the tree hoppers, which have the same habits as the harvest flies, but make no drumming sound. These hoppers can take flying leaps to a great distance, often as far as 250 times their own length. In a proportionally long jump a man would vault through the air over a quarter of a mile. These insects always stay on plants and trees, where, from their dark color and fixed position when in repose, they look much like thorns. Locust and oak trees, and many vines, suffer greatly from the sucking of the sap and the injury done to the leaves by these insects. Tobacco fumigation, or whale oil soap in solution, is sometimes an effectual remedy against them.

Some species of bugs live in fresh water, feeding on animal or vegetable juices, and their sharp-pointed beak will cruelly pick the fingers of any person who touches them. These are properly called water bugs, but are commonly known as water scorpions. They are divided into two classes, one with a long body, brownish-yellow above and yellowish-red below; the other has an oval body of a pale brown color, and a reddish yellow abdomen; of the latter class the nepa are an example.

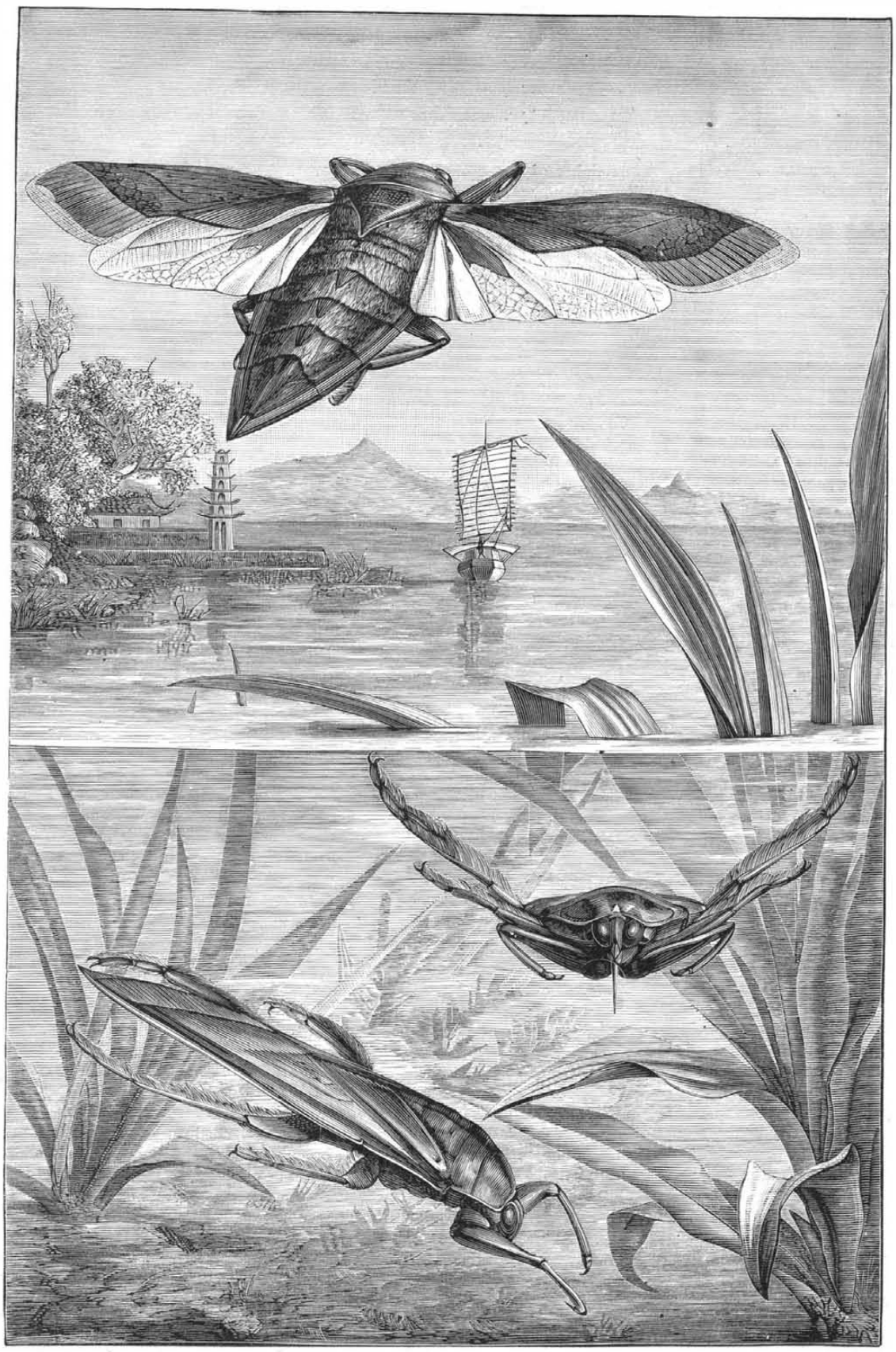
In both, the abdomen ends in a tail formed of two long tubular threads, a sort of lungs, by means of which the insect can rise to breathe at the surface of the water. These bugs are not lively; they move slowly along the bottom of the puddles or ponds among the slime and mud, and can be easily taken. They swim very swiftly, using their four posterior legs as oars; occasionally they can be seen swimming on their back. They feed on insects, mollusks, and young fish, which they seize with their front legs or nippers, and stick their sharp beak into their prey and suck the blood through the puncture. These species are found in stagnant ponds in America and Europe, on the edges of the pool among the water plants, to which the females attach their eggs. They have a very extended geographical distribution, as all aquatic species have, on account of the nearly uniform temperature of the water.

The largest known of the water bugs is the *Belostoma*, of which we give a life-size illustration. These are enormous insects, which inhabit the warm fresh waters of both continents, of similar habits to the *Nepa*. They have a long oval body; the abdomen, very flat on the sides, ends in a point. The head is proportionally small, is triangular, and inclined almost vertically to the body; the eyes are large and projecting; the beak has three joints, and the thorax is terminated by a triangular shield. The upper wings are pointed, and, when folded, cover the abdomen; the lower ones are large and membranous. Their legs are very strong; the front legs are curved, and have a groove on the underside that fits into a corresponding cavity in the body, and forms a cruel trap to hold the victims of this voracious insect. The other legs are bordered with a long fringe or cilia, and are used like oars to enable the bug to swim rapidly after its prey.

The oldest known species of *Belostoma* is found in Guiana and Brazil; this is about two inches in length. Mlle. Sibylle Meriam, who drew the animals and insects of Surinam nearly a century ago, represented this insect holding in its powerful nippers a little frog that it is trying to bleed to death.

The Indian water bug is still larger; the great water scorpion of M. Stall attains a size over three inches long; it is a pale greenish-yellow color; the prothorax and shield are brown with bands of yellow; the legs are yellow, striped with black.

This species is represented in the engraving, both flying and swimming, in the vicinity of an aquatic plant of the extreme East, the *Acharons japonicus*. This gigantic bug, like all its class, is not well known; it is occasionally found among the insects bought from Chinese merchants, and is supposed to be distributed through China, Java, the East Indies, and possibly in the neighborhood of Cairo and Algiers.—*La Nature.*



THE INDIAN BELOSTOMA.—(Natural size.)

MISCELLANEOUS INVENTIONS.

Mr. Moriz Weinrich, of Vienna, Austria, has patented an improved method of and apparatus for the production of refined sugar in plates, sticks, and other like forms. The object of this invention is to facilitate producing highly refined and pure sugar, which can easily be reduced to small cubical blocks or to lumps without any alterations of the claying rooms in use at present and without requiring any additional expense. The invention consists in a pan connected with a suction pump, and also provided with transverse bars for supporting the sugar-receiving boxes, which are subdivided by partitions or plates according to the shape and thickness of the desired slabs or sticks of sugar that are to be produced.

Mr. Madison T. Shadduck, of Shunk, Pa., has patented an improvement in tug buckles which consists in hinging the tongue plate to a lever which, in turn is hinged by connecting rods to a crossbar of the frame and adapted to be held in a locked position by a spring bolt engaging an eye bar of the frame.

Mr. John H. Atwater, of Medford, Minn., has patented an improved washing machine. In using the machine the clothes to be washed are inserted between an endless apron and a cylinder of corrugated rollers, and as the machine is operated the clothes are carried around the cylinder of rollers and are squeezed and rubbed by and between them and by the smooth rollers acting behind the apron. With this construction the corrugated rollers travel faster than the endless apron, so that the corrugated rollers will move forward upon the clothes, and will operate more effectively upon the clothes than they would if the rollers and clothes traveled at the same speed.

A novel automatic hatchway-door operator has been patented by Mr. John L. Peters, of New York city. The invention consists in an arrangement of circular racks attached to the pivoted ends of the swinging hatchway-doors, combined with sliding rack bars on the guide standards, which carry boxes at the upper ends containing sliding bolts and an angular latch lever for withdrawing the bolts when the doors have been opened. Projections on the elevator car strike against the projecting ends of the bolts and press them and the rack bars downward, and these racks will turn the circular racks, swinging the hatchway doors open. The latch levers then strike against studs and withdraw the bolts, permitting the car to descend further, the car holding the doors open. When the cars has passed, closing springs swing the doors back into their original positions.

Mr. John Murray, of New York city, has patented a novel toy savings bank, consisting of the figure of a chicken thief seated on a hencoop. At the end of a long platform, and near the opening for receiving coin, there is a fixed figure of a man and a movable figure of a dog. On dropping the coin into the bank the dog is released, and goes for the chicken thief, who runs out his tongue and rolls his eyes while the heads of chickens peep from holes in his hat, affording evidence of his guilt.

New Welland Canal.

The new Welland Canal was opened April 20, with twelve feet of water throughout its length. The increase of depth (two feet) is having a marked effect upon the commerce of the lower lakes. Most of the vessels plying between ports on Lake Ontario and the upper lakes, and which are known as "canal vessels," have a carrying capacity of about 24,000 bushels of grain, but they have hitherto been able to carry only about 18,000 bushels through the old Welland Canal on ten feet draught. They can henceforth carry full cargoes. The first coal fleet from Oswego took on, for the upper lakes, about 700 tons each vessel instead of 500 tons as before.

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SUGAR—A GLANCE AT ITS HISTORY, PRODUCTION, AND MANUFACTURE.

At a recent meeting of the Massachusetts Institute of Technology, Wm. B. Rogers, the president, introduced Mr. Jacob A. Dresser, who spoke upon the "History, Production, and Manufacture of Sugar."

Mr. Dresser first referred to the very early knowledge of sugar in China and India, and the fact that before 1000 A. D. the substance and the cane had passed into Arabia, Egypt, and Cyprus. Thence it passed probably along the northern coast of Africa, and by the Moors was taken into Spain. Its use in Europe does not appear to have been at all general until introduced by the returning Crusaders. By Spain and Portugal it was transferred to the West Indies and Brazil. The cane was probably not indigenous to America. The wonderful development of the production of sugar from the beet-root has taken place in Europe almost wholly during the present century.

The entire amount of sugar produced in Europe is from the beet, and amounts to 1,500,000 tons, being fully three-fourths of the 2,000,000 tons now produced for commercial purposes in all other countries from the sugar cane, the original source of the substance.

The advantageous growth of the sugar cane seems to be confined to the belt within about 30° both north and south of the equator, with occasional variations coinciding with the isothermal lines, and an average temperature of seventy-five to seventy-seven degrees.

That of the beet, as illustrated in Europe, seems to range between 45° and 55° north latitude, but in our own country the range will, no doubt, be found, when developed, to be essentially below that, corresponding with the difference in the isothermal lines, perhaps more nearly from 35° to 45°. In this last season some 1,800 tons of fine quality were produced in Maine and Massachusetts.

As a statement of the total sugar production of the world it may be said that each of the great central empires—France, Germany, and Austria—produces about 400,000 tons, equal together to 1,200,000; Russia, 220,000; Belgium and Holland, 100,000—total, 1,520,000. Cuba, 600,000; Brazil, 200,000; Demerara, Surinam, and the Windward Islands adjacent, 400,000; and our own Louisiana and the Sandwich Islands, 150,000 tons. This gives us from America 1,350,000 tons; Europe, 1,520,000 tons; East of Good Hope, 700,000—total, 3,570,000 tons.

Confining ourselves to the consideration of the ordinary sugar of commerce, cane sugar, so called, no description seems to be necessary, excepting perhaps to say that the crystal where perfect is rhomboidal, of four or six sides, terminating in two or three sided summits; and, when allowed to crystallize under favorable circumstances, may attain a length of one or one and a half inches, although such are rarely seen. Its specific gravity is 1·6.

Mr. Dresser next proceeded to discuss the wholesomeness of cane sugar, and said that while in the absence of nitrogenous matter it did not offer any nutriment to the muscular system, it does offer a large supply of heat, and is admitted to be fattening in its qualities; also, statistics show that a consumption of 75 to 80 pounds of sugar per person annually produces no ill effects.

Our views of the process of extraction and manufacture will be more complete if we begin at the sugar cane or the beet root.

The first claims precedence for many reasons, so we take the cane. It contains about 90 per cent of juice by weight, of which about 18 per cent is susceptible of crystallization, but this is never realized in practice.

The first problem is to extract the juice; the next to clarify it or purify it as far as possible; then to concentrate the juice, or this solution of sugar, in water with certain impurities by evaporating the water; then to facilitate and induce crystallization of the sweet principles therein, so far as we can; then to relieve these crystals of the mother liquor from which they have sprung, and which will then be molasses, and some of which will continue to adhere to the crystals unless removed by external force and appliances.

At this point we have what is called Muscovado sugar, raw sugar, or, perhaps more properly, sugar of first production, as it has been made in Cuba and elsewhere for many years. According to its treatment from this point onward it may remain as Muscovado, or become either clayed or centrifugal sugar, and is so recognized in commerce. The first process, that of extracting the juice, has been accomplished very imperfectly in various simple ways; the most primitive being still used in the East, and scarcely superior to the mortar and pestle, and quite similar thereto, excepting that the pestle or its correspondent is made to revolve by the power of oxen diagonally around the side of the mortar upon which the cane is held and crushed.

But the mill with upright wooden rollers, similar to our cider mill, seems very early to have been devised, and both forms are said now to be in use in India and China.

The great advance in science and the mechanic arts in the Western world has given us now the magnificent and well-nigh perfect iron mill, driven generally by steam; and visitors to the Philadelphia Exhibition may remember some examples of those exhibited there of giant size and strength.

Another method of extracting the juice from both cane and beet, "by diffusion," so called, long known and more practiced with the beet than cane, is perhaps quite as effective.

In this the canes are cut in diagonal slices, and exposed to successive water baths, by which nearly all the juice may be removed at the expense of increasing the amount of water to be evaporated before crystallization twenty or twenty-five per cent.

Next, the juice thus obtained, constituting at best perhaps sixty to seventy per cent of that in the cane, is to be clarified or purified, that is, freed from mechanical impurities and foreign matters accompaning it in the cane, such as albumen and certain salts and acids derived from the soil. Great dispatch is necessary, because in exposure the nitrogenous materials rapidly induce fermentation.

Clarification is accomplished by heating in large vessels, formerly by open fires, but often now by steam.

By the introduction of lime the acids are neutralized, and by the heat the albumen is coagulated, and the impurities brought up and removed by skimming, which completes the clarification after a little time for subsidence.

The next step is to reduce the volume of water. This is accomplished by heat and evaporation, but with much peril in the process to the sugar, to which heat is destructive and time is ruinous.

At as low heat and in as little time as possible, therefore (two opposing conditions), must this be done; but under the system of open fires, long universal and still used extensively, the destruction of sugar, or its conversion into molasses with its discoloration, was enormous.

SUGAR REFINING.

The refining of sugar of first product, or raw, as now produced, is now almost universally demanded before its consumption by the civilized world, and it is hazarding little to say that but for one discovery and one invention, both made about the same time (1812), it would be impossible to answer this demand. That discovery was the effect of animal charcoal, or calcined bones, upon sugar solutions, and that invention was the vacuum pan, or the method of boiling in vacuo, by E. C. Howard.

The discovery was made in France (Devoine), the invention in England. Through these alone are the stupendous operations in sugar refining now possible.

The sugar may consist of several varieties, apportioned by the judgment of the manager, so as to best attain the particular result desired in quality. It is first dissolved in hot water (say one-third), in a large tank fitted with an agitator operated by steam, and a steam-heating coil for quickening the process. When dissolved it corresponds to the juice when extracted from the cane or beet by the mills, and all possible dispatch is made to restore it again to the crystal form. From the melting tank it is pumped to an upper floor of the refinery into cisterns, called blow-ups, fitted with steam connections for heating. Here it is further clarified by albumen, and any acid tendency is converted by alkali, usually lime milk, and its weight or quantity of sugar adjusted by addition of water or sirup to some 27° or 28° Baume saccharimeter, the test generally used. In some modes of working the blow ups are now omitted, and the liquor from the melting pan is passed directly to the bag filters, which by great numbers may be made to supersede the necessity of albumen.

Bag Filters.—The construction of these can be best understood by illustration and description. Their purpose is to remove mechanical impurities still remaining in the dissolved sugar.

They consist of two long bags, says 5½ or 6½ feet long, one of close material, and 15 or 16 inches wide, placed within another a little shorter and much smaller, but of very strong open material outside, to support the inner in doing its work. These are suspended inside and from the top of a close iron tank, the mouth of each bag being attached to a circular bell or opening downward in the top of the tank. The top of the tank outside is surrounded with a low but tight fence or inclosure, perhaps a foot high, into which the liquor flows, and is conducted through the openings above spoken of into the mouths of the bags. The inclosure in which the bags are suspended contains from one hundred to six or seven hundred bags, and is steam tight to admit of its introduction for heating and facilitating the flow of the liquor, as well as to remove any sugar that may remain in the impurities or scum arrested by the bags. The tendency of late years has been to increase the number and use of the bag filters, and to dispense correspondingly with the other clarifying agents.

Charcoal Filters.—From the bags the liquor, as it is called, now enters a new and most important phase, viz., the animal charcoal filters. The effect of animal charcoal in decolorizing sugar solutions was observed about the close of the last century, and used by M. Dérosus, about 1811, who introduced it then into practical use. But at first it was pulverized and mixed with the sugar in the blow-up, and removed with the scum and lost. Afterward it was placed in shallow tanks, and the sugar passed through them; but about the year 1822 M. Dumont devised the tall filters similar in form to those now in use, and with sundry variations in size, and open or closed they have continued until now. The present scale of business requires the use of enormous quantities of this charcoal, and the filters are now made correspondingly large, say eight or ten feet diameter, and eighteen to twenty feet high. The effect is not only to filter and decolorize the liquor, but to remove acids and lime, and in some mysterious way it also promotes or facilitates the crystallizing power, increasing it, according to some, as much as ten per cent.

The filters are generally capable of being closed, so as to allow the use of pressure, which insures a more uniform distribution of the sirup, so that none of the coal remains unused, as sometimes happens without pressure. This pressure also allows the liquor to be passed over from the bottom of one filter to the top of another, when further filtration of it is required, and saving in such case the cost and expense of pumping, and the heat so desirable while filtering.

CONCENTRATION OF THE SIRUP.

The evaporation of the water, or concentration of the sirup or liquor in the vacuum pan, is the next stage, and by means of this invention of Howard we are enabled to maintain a vacuum of twenty-seven to twenty-eight inches, and hence to boil at a temperature of 130° to 170°, instead of 220° to 250°, as would be required in open air. In the early days these pans were only about six feet diameter and four feet high in the center of the elliptical section, with a capacity of twenty or twenty-five barrels of sugar.

Now there are some in New York of seventeen feet horizontal diameter and fifteen to sixteen feet high. One in the refinery of Messrs. Matthiessen & Wiechers has a capacity of boiling four hundred barrels of sugar at once, and evaporates sixty thousand pounds of water in two and a half hours, or fifty gallons per minute.

The vacuum pan and the bone-black filters may be regarded respectively as the heart and the lungs of a sugar refinery, being as vitally important to its successful working as are those organs to the well-being of animal life.

A beautiful arrangement of the vacuum pan devised by M. Rillieux, of Louisiana, called "The Triple Effet," consists of two or three pans so connected that the vapor from the first, boiling without vacuum, is conducted to and boils the liquor in the second under a partial vacuum; and the vapor from the second is conducted to and boils the liquor in the third pan, in which, though the liquor is heavier, the pan, being connected with a condenser and pumps, is under a much higher vacuum, and hence is boiled by the vapor from the second. Between the pans is the usual safety receiver, to arrest any sugar that may be carried over by the vapor. This arrangement is used more largely on plantations and in Europe in treating the beet juice.

THE CENTRIFUGAL SEPARATOR.

Formerly the sugar was passed from the vacuum pans through the intervening heater, which received it directly into the moulds (as in the claying process), for separating the mother liquor from the crystals and making them white; but for this purpose centrifugal machines are now most generally used, thus substituting steam power for the slow process of gravity. This machine consists of a kind of round metallic basket, usually about thirty inches diameter (but some are now made larger), with sides of very finely perforated brass, twelve and fourteen inches high, and surrounded by an iron curb a few inches larger, which receives the sirup from the sugar in the basket and conducts it away. This basket is either suspended by a perpendicular shaft from above, or mounted on one from below, independent of the curb which surrounds it. After being filled from one-third to one-half its weight with semi-liquid sugar from the pan, it is made to revolve in a horizontal plane one thousand and fifteen hundred times per minute. The sugar immediately rises in vertical walls at the sides, the sirup being thrown out through the perforations, and from the native yellow color it begins to grow white immediately, and after a very few minutes, if it be of first quality, a little cold water from a sprinkler makes it beautifully pure and white. It is now in condition to be removed and sold as confectioner's or coffee A sugar, or by further treatment to be made into the well-known granulated sugar of commerce.

GRANULATED SUGAR.

This very popular and strictly American style of sugar was first made and introduced by our highly respected fellow-citizen, Mr. Thomas Lamb, who conceived the idea and devised the first apparatus for making it, which he put in operation about thirty years ago at the Boston Sugar Refinery in East Boston, of which he was then president and agent. Although extremely popular in the United States since its origin, it has become popular in England only within a few years past. The apparatus at first consisted of a steam table fifteen or twenty feet long and three to five feet wide, on which the moist sugar was, by an ingenious process or movement of wooden rakes, gradually worked the length of the table, becoming thoroughly dried in so doing. Afterward it was separated by sieves of different grades or mesh, into coarse and fine, and barreled and sold accordingly. This apparatus was superseded ten or twelve years since by a large cylinder of wood or iron, some four feet in diameter and fifteen to eighteen feet long, slightly depressed at one end. The inner surface carries small projecting buckets, by which, as the cylinder revolves, the sugar, entering at the upper end, is lifted and poured through the heated interior. The heat is supplied by a small steam cylinder running through the length and center of the large one, and the position of the buckets is such as gradually to work the sugar through the length of the cylinder, during which it becomes thoroughly dried. An arrangement of sieves, as before, completes the operation.

Loaf and crushed sugar, now somewhat rare, is made in refineries in moulds, much as the clayed sugar was described as being made on the plantations, but the process is carried out far more perfectly.

Cube sugar, so attractive, and now quite generally found in hotels and elsewhere here and in Europe, is made by sawing the large loaves, or by the centrifugal process, using moulds fitted to the machine, and with partitions dividing the sugar into thin layers, or by compressing the sugar

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when moist, and baking it instead of passing it through the granulator.

The polariscope, or saccharimeter, now used for determining the strength of raw sugar, is a beautiful instrument, of which, or of its operation, I can convey only a very imperfect idea. It is based upon the scientific fact that a beam of polarized light, in passing through a solution of a given strength of pure cane sugar in water, is rotated or twisted toward the right to a certain and uniform extent, and the relative extent to which a similar solution of any other sugar, under the same conditions, rotates the light, indicates the relative purity or crystallizing power of that sugar. The arrangement of lenses in the instrument is not easily made plain without diagrams, but it is such that the operation in itself is very simple, only requiring care, and the result is read in figures on a scale attached to the adjusting thumbscrew. Various elements possibly existing in the raw sugar make experience and judgment in using the instrument very necessary, and subtle and differing conditions in the samples tested require great care and appreciation in arriving at the result.

Mr. Dresser showed samples of the raw beet sugar and the loaf; also the Muscovado, and the various raw sugars as brought from the countries producing them; also the Dutch numbers of standard colors referred to in our tariff act, and for many years acknowledged in the commercial world.

President Rogers said:

When I think of the time when Black, of Scotland, not long after the middle of the last century, discovered the reduction of the boiling point of liquids by diminution of pressure, and then think of the beautiful and practical application of this principle in the vacuum pan, where the water is extracted from a solution of sugar, I am struck with a most forcible illustration of the application of science to the practical affairs of life.

Another such illustration is again furnished when we observe that the absorbent power of animal charcoal was determined in the chemical laboratory as a scientific fact, and that it is now of such great importance in the refining of sugar.

The explanation of this fact is, however, not so easy as that of the other. Both animal charcoal and vegetable charcoal possess this absorbent power to a great degree, and it seems to be clear that it depends largely on the great increase of surface due to the enormous subdivision in the interior of the mass. The amount of adhesion and detention of a liquid in a mass depends on the amount of surface with which it comes in contact. As a very striking illustration of this, we know that platinum will, with very great difficulty, combine with oxygen or hydrogen, but spongy platinum, or platinum-black, absorbs enormous volumes of gaseous matter, so that if such a mass be plunged into a vessel containing a mixture of oxygen and hydrogen it will imbibe so much and condense them to such an extent that they combine and the platinum is brought to a condition of intense ignition.

Sugar Cane Production in 1879.

An extra census bulletin gives the cane sugar product of the census year, 1879–80, as 178,872 hogsheads of sugar and $16,573,273 gallons of molasses. The area cultivated was 227,776 acres. The average and yield by States was:

Alabama	6.627	94	795,199
Florida	7,938	1,273	1,029,868
Georgia	15,053	601	1,565.784
Louisiana	181.592	171,706	11,696,248
Mississippi	4,555	18	536,625
South Carolina	1,787	229	138,944
Texas	10,224	4,951	810,605

The Elevated Railways in New York City.

The railway year in this State ends on the 30th of September. The first half, therefore, of the current year expired March 31. During the six months embraced in this period the Manhattan Railway Company carried over its lines 42,961,639 paying passengers. This would make the daily average, including Sundays, holidays, etc., 237,305, but if the Sunday travel, when two of the four lines are closed and the traffic on the other two is very light, was deducted from, it would give an average for weeks days of over 250,000, or considerably more than 10,000 an hour throughout the entire day if the traffic was equally distributed, which, however, it is not. The local travel in this city, no matter what proportions it may in time assume, must always be as now, very much heavier in the mornings and evenings than at other times. The reasons for this are so clear that to even refer to them seems superfluous, yet there are those who assert that if five cents was made the rate of fare at all hours the travel throughout the day would be uniform, or nearly so, and the pressure of traffic during the present commission hours would be greatly relieved.

This is in no sense true, as any one who stops to think a moment must readily see. People do not ride over the elevated roads at certain hours because the fare is five cents, but because their business requires them to be down town by a certain time in the morning, and permits them to return to their homes at certain hours in the evening. They do not time their riding to meet the commission fare, but the commission fare has been timed to suit them. No doubt if five cents was made the uniform rate of fare throughout the day the travel over the roads would be heavier during the hours in which ten cents is now charged, but it would not reduce the present commission traffic in the slightest, so that the argument that the roads could be more safely operated if the fare was made uniform at five cents is simply absurd and must so appear to every intelligent man.

During the six months to which we have referred several casualties have occurred, four or five resulting fatally, but they form no exception to those which preceded them, none of them being chargeable to the culpability or negligence of the company or its servants. So far in the history of the elevated roads not a single passenger has been injured through collision, derailment, explosion, fire, or any other cause where there was not more or less contributory negligence on the part of the sufferer, and we trust the last half of the current railway year may furnish no exceptions to this gratifying record.—*Elevated Railway Journal.*

Progress of Electric Lighting in New York City.

The installation of the first district of the Edison Electric Light Company in this city is almost completed. The district is nearly a square mile in extent, being bounded on the east by the East River, on the south by Wall street, on the west by Nassau street, and on the north by Spruce street, Ferry street, and Peck Slip. The buildings purchased by the company to be used as a central station to generate the electric current to be distributed over the district by means of underground cables, are located at Nos. 255 and 257 Pearl street, a little south of Fulton street. For the present only one of these buildings, the one at No. 257 Pearl street, is being fully equipped. The preparation of this district for lighting has involved a vast amount of work, which, generally speaking, may be divided into four branches, namely, the structure or the preparation of the building for the reception and maintenance of the plant, the manufacture and installation of the engines, dynamos, and other electrical apparatus, the manufacture and laying of the underground conductors, and the wiring of houses.

The work on the first of these items, to wit, the central station structure, includes the masonry foundation and concrete, a two story iron frame work, vaults under the sidewalk and streets, four boilers with an aggregate capacity of 1,000 horse power, boiler fittings, two smokestacks (each 5 feet in diameter and 80 feet high), steam conveyors for coal and ashes, shafting, blowers, and the pumping and blowing apparatus. The above work is all finished, and the hoists and ventilating apparatus, also belonging to the central station structure, alone remain to put in. The station equipment consists of six engines, six dynamos, and the resistance and regulators. The engines have been built by the Southwark Foundry and Machine Company, Philadelphia, and delivered to us. There are six of them, each having a normal capacity of 125 horse power, and a maximum capacity of 200 horse power, making a total maximum capacity of 1,200 horse power. The six dynamos, being built at the Edison Machine Works, Goerck street, New York city, are approaching completion. The resistance and regulator apparatus is also nearly completed. The weight of each of these six steam dynamos is 30 tons, making the aggregate weight of the six dynamos 180 tons. The weight of the entire structure and electrical apparatus, at No. 257 Pearl street alone, will be about 500,000 pounds—that is to say, about 250 short tons—and this weight will be distributed so as to average only about 200 pounds per square foot of structure. The boilers in this one building, when under full headway, will consume 1,680 tons of coal and 4,200,000 gallons of water per annum, equivalent to a daily consumption of about five tons of coal and 11,500 gallons of water.

As regards the underground conductors, work is being pushed as rapidly as possible. Prior to March 1, 1882, 39,403 feet of the underground mains had been laid. In the month of March 15,898 feet more were laid. In that month there were 27 working days and 4 Sundays, but owing to the loss of 5 days from rain and 2 from other causes, we worked only 20 days and 1 night, the average feet laid per day during the month being 588; the average for the days which we actually worked being 795; the least amount laid in any one day being 423, and the largest amount laid in any one day being 1,246 feet. There yet remains to be laid something over 18,000 feet of the mains, besides bridges and connections at street intersections, which, it should be stated, will take a much longer time, per foot, than the regular mains.

Regarding the wiring of houses, they were finished early in February. We have completely wired 107 places in Beekman street, 166 in Fulton street, 75 in John street, 78 in Maiden Lane, 97 in William street, 46 in Front street, 68 in Nassau street, 43 in Pearl street, 36 in Cedar street, 28 in Pine street, 24 in South street, 31 in Ann street, 12 in Spruce street, and enough more in other streets to make a total of 946 places wired.

The number of lamps arranged for in the places thus wired is 7,916 A (16 candle) lamps, and 6,395 B (8 candle) lamps, making a total of 14,311 lamps. The lamps themselves were made months ago and are now in store ready for use. The central station will supply electric current not only to illumine these and additional lamps, but also to run motors for elevators, hoistways, printing presses, and machinery of all kinds. From all that is stated above, it will be seen that little now remains to be done, except to finish the laying of the underground conductors before the first district will be entirely completed and the lighting-up commenced.

ON Feb. 8 the first eel taken in California was caught on the eastern shore of San Francisco Bay. It measured 3 feet in length, and was the first result of the "plant" of the California Fish Commissioners.

Drainage of the City of Mexico.

At a recent meeting, in this city, of the American Society of Civil Engineers, Mr. Ricardo Orozco, C.E., of Mexico, exhibited and explained the plans and profiles of the proposed works of drainage of the Valley and City of Mexico. The explanations were translated by Mr. Theophilus Masac, C.E.

The city of Mexico is situated in a basin without natural outlet. The Lake Texcoco, within a very short distance of the city, in times of flood overflows and affects deteriously the city to such extent that its sanitary condition has become very bad.

A short distance farther from the city are the lakes Chalco and Xochimilco, which also overflow toward the city.

Three other lakes, at more considerable distances, are in the same basin. There are no natural outlets, only evaporation lowering the areas of the waters.

The extreme desirability of securing drainage from this basin has been long felt.

In the seventeenth century Señor Enrico Martinez, an engineer under the Spanish authorities, constructed a tunnel partially through the mountain Nochistongo, which, however, never was entirely completed. Many years afterward the Jesuit fathers made an open cut down to the tunnel. This work cost a very large amount of money and many lives. Proper slopes were not maintained, and the work caved in frequently.

The drainage has never been properly kept up.

Señor Orozco's plan is to construct an open canal upon such grade as will entirely drain the lakes Xochimilco, Chalco, and Xaltocan, and also maintain at regulated surfaces the lakes Texcoco and Zumpango.

Through the city of Mexico are to be constructed sewers flushed by the waters from the lakes, which are carried to a common conduit, where the sewage is purified by deposition, the solid matter to be used for fertilization and the water carried away in the canal. The whole length of the canal would be about 50 miles. Expense about $7,000,000.

Maps, profiles, and plans, executed in a remarkably fine manner, were exhibited.

Ancient Chinese Coffins.

A recent number of the *Celestial Empire*, referring to a discovery of some ancient graves near Shanghai, gives, says *Nature*, an interesting account of Chinese burial in former times. A man of means purchased his coffin when he reached the age of forty. He would then have it painted three times every year with a species of varnish, mixed with pulverized porcelain—a composition which resembled a silicate paint or enamel. The process by which this varnish was made has now been lost to the Chinese. Each coating of this paint was of some thickness, and when dried had a metallic firmness resembling enamel. Frequent coats of this, if the owner lived long, caused the coffin to assume the appearance of a sarcophagus, with a foot or more in thickness of this hard, stone-like shell. After death the veins and the cavities of the stomach were filled with quicksilver for the purpose of preserving the body. A piece of jade would then be placed in each nostril and ear, and in one hand, while a piece of bar silver would be placed in the other hand. The body thus prepared was placed on a layer of mercury within the coffin; the latter was sealed, and the whole then committed to its last resting place. When some of these sarcophagi were opened after the lapse of centuries, the bodies were found in a wonderful state of preservation; but they crumbled to dust on exposure to the air. The writer well observes that the employment of mercury by the Chinese of past dynasties for the purpose of preserving bodies ought to form an interesting subject for consideration and discussion in connection with the history of embalming and "mummy making."

Solvent for Gallic Acid.

Mr. Frederick Long says, in the *British Medical Journal*, that he has accidentally discovered a method of dissolving gallic acid. Having a short time since a case of hæmaturea, the result of uric-acid gravel, he chanced to prescribe a mixture containing half a drachm of gallic acid and a drachm and a half of citrate of potassium, and, to his surprise, he found he had a perfectly clear liquid, the gallic acid being completely dissolved. He has since made further experiments, and he finds that, with care, twenty grains of citrate will dissolve as much as fifteen grains of gallic acid in an ounce of water, and remain quite clear for any length of time. To be able to give gallic acid in perfect solution is a great advantage, as absorption must take place more rapidly when the salt is in solution than when simply suspended in mucilage. The citrate, being a very simple salt, can do no harm in any cases in which gallic acid is required.

The Wisdom Teeth and Deafness.

Robert T. Cooper, M.D., in the *Dublin Journal of Medical Sciences*, reports several cases where he believes that the deafness owed its origin in each patient to a tardy or otherwise abnormal eruption of the wisdom teeth. That the teeth are often the unsuspected cause of deafness, he infers, first, "from the intimate sympathy existing between the teeth and the ears, and the consequent very obvious prejudicial effect of infantile dentition upon these organs. And, secondly, from observing the number of cases of deafness met with that date their initiation from the period of life at which these teeth appear."

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Phosphorescence in Plants.*

In living vegetables emissions of light have been observed in a dozen phænogamous plants and in some fifteen cryptogamous ones. The phosphorescence of the flowers of *Pyrethrum inodorum, Polyanthes* (tuberose), and the *Pandani* has been known of for a long time. Haggren and Crome were the first to discover such luminous emanations from the Indian cress and marigold, and a few years ago I myself was permitted to observe, during a summer storm, a phosphorescent light emitted from the flowers of a nasturtium (*Tropæolum majus*) cultivated in a garden at Sarthe.

Several botanists have also spoken of the greenish light from the *Schistostegia osmundacea*, a small plant of the moss family, inhabiting caverns, more particularly in the north of Europe. In this case, however, the phenomenon, which is somewhat complex, is produced by the persistent protonema of the plant, which reflects a beautiful emerald-green color. Meyen, also, has called attention to a small alga of the group of the oscillatoriæ, which, inhabiting the waters of the Atlantic at the equator, is both colorless and luminous. But such emissions of light are especially peculiar to the fungi. The agaric of the olive tree (*Agaricus olearius*), which is remarkable for its beautiful golden yellow color, grows in Provence in the months of October and November, at the base of olive trees and on the trunks of the hornbeam and oak. Mr. Tulasne has remarked that this toadstool, when still young, gives out a bright light and remains endowed with this remarkable property as long as it continues fresh. The seat of the phosphorescence is most usually the surface of the hymenium, although the stipe or stem is also sometimes phosphorescent in some species. The agaric of the olive tree gives out its light only while living; with its death the phenomenon at once ceases. The light emitted is white, steady, and uniform, and resembles that from phosphorus dissolved in oil. This light contains the radiations belonging to the different regions of the spectrum; and when it is produced there is always observed an active absorption of oxygen. The light of a phosphorescent toadstool is extinguished in hydrogen, carbonic acid, or nitrogen. The brilliancy of the white light emitted, far from increasing in pure oxygen, is diminished. As well known, it is the same with regard to phosphorus, which does not shine in pure oxygen.

Below 3° to 4° the phosphorescence disappears, to reappear when the temperature rises; attaining its maximum at 8° to 10°.

We know of still several other luminous toadstools: *Agaricus igneus*, which grows in the Island of Amboin; *A. noctilucens*, observed at Manila (Philippine Islands); *A. gardneri*, which grows in the Brazilian province of Goyaz, on the dead leaves of a dwarf palm; and *A. lampas* and some other Australian forms. The *Agaricus gardneri* was discovered in Brazil by Mr. Gardner. This learned botanist met with this species during a dark night in December in walking through the streets of Villa de Natividate. Some boys were amusing themselves with what he at first supposed to be a kind of large firefly, but on inquiry he found it to be a beautiful phosphorescent toadstool which grew abundantly in the neighborhood on the dead leaves of a dwarf palm. The whole plant gives out at night a bright light similar to that emitted by the larger fire-flies, and having a pale greenish hue. This circumstance, and its growth on a palm, had given it the name among the inhabitants of "flor de coco." The same fungus grows also in Borneo.

"The night being dark," says Dr. Cuthbert Collingwood, in his account of the Bornean plant, "the fungi could be very distinctly seen, though not at any great distance, shinning with a soft pale greenish light. Here and there spots of much more intense light were visible, and these proved to be very young and minute specimens. The older specimens may more properly be described as possessing a greenish luminous glow, like the glow of the electric discharge, which, however, was quite sufficient to define its shape, and, when closely examined, the chief details of its form and appearance. The luminosity did not impart itself to the hand, and did not appear to be affected by the separation from the root on which it grew, at least not for some hours."

The same writer also adds: "Mr. Hugh Low has assured me that he saw the jungle all in a blaze of light (by which he could see to read), as, some years ago, he was riding across the island by the jungle road; and that this luminosity was produced by an agaric."

Mr. James Drummond discovered in Australia two toadstools which at night gave out an extremely curious light. One species was growing on the stump of a *Banksia* in Western Australia. When the plant was laid upon a newspaper it emitted by night a phosphorescent light which enabled persons to read the words around it, and it continued to do so for several nights with gradually increasing intensity as the fungus dried up. The other species was detected some years afterward. This specimen measured sixteen inches in diameter, and weighed about five pounds. This plant was hung up to dry in the sitting-room, and on passing through the apartment in the dark it was observed to give out the same remarkable light.

The luminous radiations of these cryptogams are very varied in their character. We have already seen that the light emitted by the olive tree agaric is white, steady, and uniform; *Agaricus igneus* shines with a bluish light which recalls that which the leaves of the poke (*Phytolacca decandra*) give out at times; while *A. gardneri* emits a greenish light.

But this phosphorescence is in no wise confined to the genus *Agaricus*, for recently in our own country (France) I have observed *Auricularia phosphorea* and *Polyporus citrinus* emitting luminous radiations. The first of these grows on partially rotted trees, and the other on the trunks of willows, oaks, and apple trees. Some time ago, a remarkable case of luminosity was recorded as occurring in England: "A quantity of wood had been purchased, and afterward dragged up a hill to its destination. Among this was a log of larch or spruce. Some young people going to pass the night on the hill, were surprised to find the road strewn with luminous patches, which, when more closely examined, proved to be portions of bark or little fragments of wood. Following the track, they came to a blaze of white light which was perfectly surprising. On examination, it appeared that the whole inside of the bark of the log wa covered with a white byssoid mycelium, of a peculiarly strong smell, but unfortunately in such a state that the perfect form could not be ascertained."

Mr. Tulasne was the first to make known the spontaneous phosphorescence of dead oak leaves. "These leaves," says the learned mycologist, "were all of the preceding year, and had fallen naturally at the approach of spring. Their tissue still possessed elasticity and great cohesive strength. None of them was luminous on its whole surface. In general, the most brilliant points were those where the brown or gray color of the leaf was lightest—those especially that a peculiar alteration of the parenchyma had rendered very thin and almost whitish. I also saw shining in the same way, buds that were dried up and partially destroyed, as also a small twig that had certainly perished on the oak that had produced it. The disarticulated surface of this twig alone gave out a bright light. The brilliant surfaces of these different objects were all more or less moist with water. Wiping them off with the finger diminished their brilliancy, yet it was necessary to rub them briskly for some instants to render them dark, and no phosphorescent matter adhered to my hand."

The rhizomorphs, or vegetative apparatus, of a large number of fungi are likewise phosphorescent. These productions extend beneath the soil in long branching cords and threads in the vicinity of old stumps, especially of the oak, which are in a state of decomposition, and to which they are affixed by some of their threads.

All these plants that we have just mentioned emit light during their life and when they are in a state of decomposition. We might also cite the phosphorescence of the milky juice of certain *Euphorbiaceæ*, and of the pulp of certain fruits (such as that of the peach and apricot) that are beginning to decay, but we think that we have said enough to demonstrate the frequency of the phenomenon of phosphorescence in the vegetable kingdom.

* Abstract of an article by Louis Crie, in the *Revue Scientifique*.

Microscopic Notes.

BORING ANNELID.

At a recent meeting of the New York Microscopical Society, Mr. J. D. Hyatt exhibited some specimens of a boring annelid, and described, by the aid of blackboard drawings, the probable method of excavating in hard substances. He showed two mounted specimens, one with the jaws extended, and one in which the head was retracted far back into the body of the animal.

The track of an annelid, as Mr. Hyatt had found by cutting sections of shells, was always downward and then back to the surface in a line parallel with and close to the original channel, so that frequently a section across the borings shows either two channels with a very thin partition between them, or else without any wall of division.

Remarks were made by several members of the society, particularly concerning the method of boring. It was thought by some that the apparatus for boring described by Mr. Hyatt could not be hard enough to penetrate solid rock, but the weight of evidence seemed to be conclusive that no chemical action assisted in the process.

STRUCTURE OF SPONGES.

Mr. Hitchcock described the structure of sponges. His remarks were principally based upon the description of sponges in Saville Kent's "Manual of the Infusoria." According to Mr. Kent's observations and also to others by Carter and by our countryman, Prof. H. James Clarke, the sponge consists of a mass of clear, homogeneous, jelly-like matter, the cytoblastema, traversed by ramifying canals which are enlarged in places. The cytoblastema is covered with an imperfectly differentiated investing membrane, and the spicules are embedded in it. The canals are enlarged into chambers at different points, and these chambers, known as ampullaceous sacs, are lined with spherical or oval monads, each of which has a hyaline, bell-shaped collar at the anterior end, through the center of which a long flagellum extends into the chamber. These collared monads also line the channels in some species of sponges. By the constant lashing of the flagella, currents of water are drawn through the pores, the small openings on the surface of the sponge, into the ampullaceous sacs, and from these they pass to larger channels which lead to the larger openings or oscula at the surface. This constant circulation provides the sponge with air and food.

Within the cytoblastema are a great number of amœboid bodies which are difficult to distinguish from the mass in which they are embedded. By the coalescene of these amœboids, which seem to be derived by a direct transformation of collared monads, one process of reproduction is accomplished. The other processes of reproduction were described.

Sponges appear to belong to the protozoa, although some authors believe they should be classed among the metazoa. The speaker was fully convinced of their protozoic nature.

DETECTION OF QUINIA.

At a recent meeting of the State Microscopical Society of Illinois, Mr. E. B. Stuart read a paper entitled "Notes on the Iodo-sulphate of Quinia."

The speaker stated that some time ago it became desirable to ascertain if a certain sample of muriate of morphia contained traces of quinia. He found no published reference to the action of morphia on the iodo-sulphate test of Herapath. This test had been a favorite with him for some time, partly on account of the ease with which it could be applied, and partly on account of the certainty of the reaction. He first tried the reaction on a solution containing one part of quinia and nine of morphia. The morphia in this mixture did not prevent the formation of the iodo-sulphate of quinia; nor did it have any effect when the morphia was in the proportion of 1,000 to 1 of quinia.

The mode of performing this test was to dissolve the salt in dilute alcohol, by the aid of sulphuric acid, and the solution warmed to about 100° F. Very dilute tincture of iodine is then added, drop by drop, with constant agitation. When a sufficient quantity of iodine has been added, the precipitate appears and quickly subsides.

In a mixture of the four principal cinchona alkaloids, the quinia is first separated, then the cinchonidia, which is followed in turn by the quinidia, and finally by the cinchonia. The latter reaction takes place very slowly, however, and only in tolerably concentrated solutions.

The separation of cinchonidia from quinia by this method is far from complete, and unless present in large proportion, all the cinchonidia is likely to be precipitated along with the quinia. On recrystallizing from alcohol, however, the two salts separate and can be distinguished by the microscope, although not very readily. After crystallization, the shape of the crystals becomes definite, mostly appearing in thin rhombic prisms.

DETECTION OF FATS.

Mr. Wm. Hoskins spoke of the differences between the crystallization of the fat of butter and that of lard, tallow, and other fats. The speaker stated that, upon melting and then cooling the clarified fats slowly, the differences in the crystallization of the various fats were very marked, and that he was enabled in this way to distinguish positively, adulterations of suene, oleomargarine, etc., in butter.

Important Discoveries in Central America.

The French explorer, M. Desire Charnay, announces that he has succeeded in penetrating the country of La Candones in Northern Guatemala, where he has visited the large city popularly known through Central American explorers as "The Phantom City."

Mr. Rice, of the *North American Review*, to whom M. Charnay sends this report and at whose request the attempt was made, tells the *Tribune* that when the explorer Stephens visited the village of Santa Cruz de Quiche, Guatemala, forty years or more ago, he learned of the existence of a great inhabited city in the Sierra de Guerra (land of war), the region in the northwestern part of Guatemala occupied by the Candones or Lacandones, a tribe of people said to this day to perpetuate the traditions and the mode of life of their Maya forefathers. Though nominally subject to the laws of the Republic of Guatemala, the Lacandones are in fact absolutely independent, and jealously refuse white men entry into their settlements. Stephens thought that a force of 500 men would be necessary in order to overcome the resistance of the natives to the intrusion of an exploring party.

Mr. Stephens was assured by the *cura*, or parish priest of Quiche, that he himself, while still a young man and living in the village of Chajul, had climbed to the summit of a bare and lofty peak of the neighboring sierra, and had then, at a height of ten thousand or twelve thousand feet, looked over an immense plain, extending to Yucatan and the Gulf of Mexico, in the midst of which, at a great distance, he saw a large city spread over a considerable space, with turrets white and glistening in the sun. This place was, according to the *cura*, "a living city, large and populous." From other sources Stephens learned that from the sierra a large ruined city was visible; while others, who had climbed to the same elevation, had seen nothing, owing to a "dense cloud resting on it." Later writers pretty generally relegate this city to the class of phantoms and mirages, or of fables. Yet in itself the *cura's* story is in no wise improbable, for there are throughout that entire region, in Guatemala, Yucatan, Chiapas, Tabasco, etc., to be seen, in ruins, it is true, hundreds of places, cities, which, while they flourished, must have presented just such an appearance as that described by the old *cura*. And it is worthy of note that Stephens—an embodiment of common sense, an explorer who had never a pet theory to support—saw no reason to doubt the truth of the padre's story.

M. Charnay's telegraphic announcement of his success does not tell by what means he was able to penetrate to the "Phantom City," nor in what condition he found it. Whether inhabited or not it is expected that it will be the means of throwing much light upon problems of Central American archæology.

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Business and Personal.

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Steam Pumps. See adv. Smith, Vaile & Co., p. 236.

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For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 237.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423. Pottsville, Pa. See p. 238.

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See Bentel, Margedant & Co.'s adv., page 268.

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Gould & Eberhardt's Machinists' Tools. See adv., p. 269.

For Heavy Punches, etc., see illustrated advertisement of Hilles & Jones, on page 269.

Engines, 10 to 50 H. P., $250 to $500. See adv., p. 270.

Barrel, Key, Hogshead, Stave Mach'y. See adv. p. 269

Lehigh Valley Emery and Corundum Wheels and Grinding Machinery of all kinds. Please write for prices, stating sizes of wheels you use, etc. Lehigh Valley Emery Wheel Co., Lehighton, Pa.

Fine Taps and Dies in Cases for Jewelers, Dentists, Amateurs. The Pratt & Whitney Co., Hartford, Conn.

C. B. Rogers & Co., Norwich, Conn., Wood Working Machinery of every kind. See adv., page 270.

For best low price Planer and Matcher, and latest improved Sash, Door, and Blind Machinery, Send for catalogue to Rowley & Hermance, Williamsport, Pa.

The only economical and practical Gas Engine in the market is the new "Otto" Silent, built by Schleicher, Schumm & Co., Philadelphia, Pa. Send for circular.

The Porter-Allen High Speed Steam Engine. Southwork Foundry & Mach. Co., 430 Washington Ave., Phil. Pa.

The Sweetland Chuck. See illus. adv., p. 270.

Telegraph, Telephone, Elec. Light Supplies. See p. 268.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Also manufacturers of Soloman's Parallel Vise, Taylor. Stiles & Co., Riegelsville. N.J.

Electric Lights.—Thomson Houston System of the Arc type. Estimates given and contracts made. 631 Arch, Phil.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their identification.

(1) J. H. asks: How can I make a paste or composition for ornamenting picture frames such as picture frame makers use? A. See answer to A. K. this page.

(2) W. S. B. writes: I have a valuable plumbago mine and am obliged to sell a share in it, but don't know the actual value of it. Will you please inform me as to the price per pound of pure plumbago? A. From one to four cents a pound.

(3) H. B. N. asks: 1. What cement should I use for fastening the carbon plate of a bichromate of potash battery to the metallic conductor? A. No cement is employed. Use a metal clamp. 2. Is the inclosed fragment kaolin; if so, of what grade? A. The substance inclosed is an impure kaolin.

(4) H. C. asks: 1. Can you give me a simple method of mounting or stretching lithographs for framing without glass? A. Use dry cotton cloth of uniform thread, free from knots and similar imperfections. Stretch and tack the cloth over the frame, then go over every part of it with a moist sponge, and having brushed the back of the lithograph to be mounted with good clear, thick, cornstarch paste (to which has been added a trace of clove oil), spread it smoothly, face down, on a cloth-covered table. Then adjust the cloth back over it, and with a small cloth cushion go quickly over every part, from the center to the edges, with just pressure enough to drive out all excess of paste and air bubbles, and set it aside in a moderately warm place to dry slowly. 2. What kind of varnish should be used for varnishing lithographs, and method of applying? A. Use good, clear mastic or amber varnish, or any of the picture varnishes commonly sold for this purpose. 3. Can you give me a cement suitable for patching rubber boots, and method of applying? A. See "Cements," in SUPPLEMENT, No. 158. 4. What would you recommend for cleaning and polishing bright work (iron and brass) on an engine? A. Emery flour, mixed with a little sperm oil, is very good for this purpose. 5. Can you tell me anything to prevent rust on the bright work of machinery when not in use? A. Clean and dry the metal thoroughly, and smear every part with a mixture of fine lard and camphor (lard 10 pounds, camphor three ounces, mixed in a mortar by aid of gentle heat). After twelve hours, rub off excess of this mixture with dry rags. 6. Are the heads of small boilers screwed on the ends of the shell equal to or better than riveted? A. Rivets are preferable. 7. Is a boiler better full of water or empty when standing for some time, and why? A. It is better to blow out and thoroughly clean a boiler that is to remain out of use for any length of time. 8. Is well water, rain water, or soft spring water best for boilers, and why? A. Rain or soft water is best for steam-making purposes, because it contains no (or very little) foreign matter—liable to form incrustations on or corrode the plates—in solution.

(5) A. K. asks: Will you please tell me how the fine gilt frames are manufactured that are seen on large pictures? I have tried plaster of Paris, and then gilded it, but it breaks very easily. How is the original made? Is it cut out of wood or metal—if so, what kind? A. These frames are generally moulded from a composition composed of fine whiting (lime carbonate or powdered chalk) and hot glue or size. The whiting is simply worked up into a dough with the thin glue size solution, pressed into form, and allowed to dry and harden. Some of these frames are now made of papier mache—pulped paper, mixed with glue and whiting or clay. The gold leaf is attached with sizing, allowed to become nearly dry before attaching the leaf, which is afterward burnished.

(6) E. T. G. writes that he has had a fan blower demolished, with considerable blast pipe, by the explosion of gas on starting the blower after dinner, and he asks for an explanation and a remedy. A. A heavy inflammable gas, composed largely of carbonic oxide from the anthracite fires, enters and mingles with the air in the pipe and blower case. This mixture, in certain proportions, is explosive. When the fan is started a portion enters the fire and ignites the whole mixture. The remedy is to induce sufficient draught to carry off this heavy gas during the time the fan is stopped.

(7) J. W. W. asks: Is there anything to stop a boiler from foaming? A. Yes; but it is important first to know the cause. Sometimes a small quantity of oil sent in through the feed pump will effect it. 2. Is the water from the cylinder which is mixed with oil hurtful to a boiler? A. No. 3. I have been running a portable mill for the last year with no trouble until lately, when all at once the water rose in the boiler and rushed out with the steam, when I have to stop and refill the boiler with fresh water, which will run for a few hours only, causing a great deal of trouble and danger. A. It must be due to the foreign matter in the water. You should have the water analyzed.

(8) H. P. asks: Can you inform me, through the columns of the SCIENTIFIC AMERICAN, to which I am a subscriber, if there is any method of casting brass articles about an eighth of an inch thick, without any of the small particles of sand that adhere to the surface; in other words, to produce a perfectly clean casting? I have tried casting in warm metal moulds instead of the ordinary sand moulds, but the articles are so thin that the metal gets cold before it has run all over the mould. Having noticed some very fine American iron castings that are being sent into this country, I thought it possible you might give me some information A. Small clean castings are made in sand moulds only. Great care must be taken in selecting the sand. The fine yellow loam sand found in Albany and Columbia county, in this State, is mostly used in the vicinity of New York for fine brass work. Dusting the moulds with fine wheat flour adds much to the cleanly appearance of the castings. If the patterns have sharp corners or other markings the moulds can be warmed to great advantage by holding a hot plate of iron over them, for a few minutes before closing and pouring. The composition of the metal is also of the utmost importance in making the surfaces bright and clean. A composition of 1 pound copper, ½ ounce tin, ½ ounce zinc, ¼ ounce lead, make a rich golden color, and when taken out of the mould and dipped in water quickly after pouring brings out a fine surface color. All patterns where fine surfaces are required should be of metal and very smooth. The above remarks are also applicable to iron castings as far as selection of sand and finish of patterns go. The moulds should be dusted with finely ground charcoal or plumbago. The quality of the iron is most important and should be fine grained and very fusible. The "Berlin castings," so celebrated for fineness, are supposed to be an alloy of iron and arsenic.

(9) Z. A. Q. writes: Please give some receipt for filling small pieces of walnut, such as gun stocks, bracket work, etc., to be used before putting shellac on. A. Make a thin paste by triturating together starch and water glass sirup (30 per cent solution). Warm the wood (which should be dry), and rub this filler well into every part intended to hold the filler. Then let it get thoroughly dry, and rub it down well before varnishing.

(10) A. L. B. asks: Please inform me how kid gloves are cleaned? A. Mix dry potter's clay into a thin paste with "deodorized" benzine; mount the gloves on suitable dummy forms, and go over every part with this paste. Then plunge the gloves into a quantity of the pure benzine for half an hour; press out excess of liquid, dry in the air, and then rub into every part as much of a mixture of equal parts of the yolk of eggs and flour as the material will absorb. For white leather substitute half glycerine and white of egg for the yolk.

(11) R. R. S. writes: In your issue of the SCIENTIFIC AMERICAN, March 11, 1882, we notice an article on the cleansing of soiled chamois leather, in which we are interested, as we often are obliged to do it. There is, however, one term the meaning of which we do not understand: "yellow soap." What kind of soap is this? A. Yellow or resin soap is the common variety of laundry soap, usually sold in bars.

(12) A. T. asks: Can you tell me how to strip nickel from goods for replating? A. See "Electro-metallurgy," in SUPPLEMENT, No. 310.

(13) H. F. asks: Where is the greatest pressure in a steam boiler, at the top or at the bottom; and how much does the pressure differ? A. At the bottom. The water adds 1 pound pressure for each 27 inches depth.

(14) J. N. D. writes: 1. I have a 12x20 inch engine, running 100 revolutions a minute, supplied with steam through a 2 inch pipe. Is this not too small? A. Yes; it should be 2½ inches to 3 inches diameter. 2. I wish to test my boiler. Can I fill boiler and drum with water and get sufficient expansion by heating without reaching the boiling point? A. Yes; but the test should be made very carefully, firing with light chips or shavings, so that the fire could be instantly hauled or put out as soon as the pressure is reached.

(15) W. W. writes: I want to put a pipe condenser for exhaust steam outside a small boat. The water condensed will, of course, collect in the lowest part of this pipe. Will the exhaust steam be able to force this water upward, say 18 to 24 inches, without strain on the engine or loss of power? A. No; it should be drawn from the pipe by the air pump.

(16) J. C. asks: 1. Can a hand force pump be made to draw water from a well 20 feet deep, with horizontal pipe, the vertical height below cylinder to surface of water being about 13 feet, horizontal distance being 25 feet? A. Yes. 2. Will there be sufficient force for fire purposes? A. Yes; if enough power is applied. 3. What sized pipe will be needed? A. Pipe not less than half the diameter of pump.

(17) J. Y. B. asks: What is the size of the Bristol's engine, of the Fall River Line, that is, horse power, stroke, and diameter of cylinder? A. Cylinder 110 inches diameter by 12 feet stroke. In ordinary working, about 2,000 or 2,100 horse power.

(18) J. M. asks: What length and beam of a boat would be required for a boiler 20 inches diameter and 3 feet high, with 120 brass tubes, 20 inches long? Boiler has waterback round fire box, with engine 3x4, estimated weight of boiler and engine 500 pounds. Would a boat 23 feet long with 5 feet beam be suitable? A. About 22 feet in length and 5 feet beam. It might be made two or three feet longer

(19) J. A. asks if it will make any difference in the capacity of a rope in drawing a 500 pound weight up by the end of the rope or drawing it up by having the rope over a pulley. A. The only difference will be the power required to overcome the friction. The strain upon the rope to which the weight is attached will be the same in either case.

(20) J. O. asks: 1. Can an experienced machinist tell the exact quality of steel by the polish? A. No. 2. Can an experienced man detect the good from the bad steel after the metal has been manufactured into knife blades? A. Not without some kind of test. 3. Why is hand forged cutlery better than other kinds? A. Probably because the hand hammering compacts or fines the grain of the steel.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

April 11, 1882,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for 25 cents. In ordering please state the number and date of the patent desired and remit to Munn & Co., 261 Broadway, corner of Warren Street, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

Advertising device for street cars, R. F. Bridewell	256,424
Air compressor, M. S. Manning, Jr.	256,232
Air ship, C. W. Petersen	256,366
Alarm. Fee Burglar alarm.	
Almanac, G. G. Green	256,316
Amalgamator, W. T. Browne	256,283
Annunciator, J. G. Arnold	256,190
Aquarium, C. N. Orpen	256,240
Axle box, car, S. A. Bemis (r)	10,081
Axle lubricator, G. D. Young	256,187
Bag. See Mail bag.	
Bale band cutter, T. C. Doolittle	256,301
Bar. See Harvester cutter bar.	
Bath and camera, combined, J. Lefeuvrier	256,148
Bed bottom, spring, W. C. Bailey	256,268
Bed bottom, spring, A. J. Landon	256,335
Bed, invalid, C. M. Türk	256,176
Bed spring, H. Fosburgh	256,431
Bedstead, folding cabinet, F. Steinbrenner	256,449
Bedstead lock, C. H. Clark	256,289
Belt fastener, A. W. Weed	256,259
Berth, self-leveling, L. D. Newell	256,239
Beverage, tonic, J. W. Decastro	256,129
Billiard table, M. Bensinger	256,114
Blind adjuster, O. C. Velie	256,254
Block. See Saw mill head block.	
Board. See Dash board.	
Bobbin winding machine, Campbell & Clute	256,197
Boiler. See Steam boiler.	
Boiler fittings, safety plug, and valve for, J. J. Mackedon	255,344
Bolt. See Plow bolt.	
Book back, spring, F. Schubert	256,345
Boot and shoe heel plate, E. C. Gardner	256,311
Boot and shoe last, C. P. Sherman	256,168
Boot or shoe, C. W. Shippee	256,170
Boot strap, J. B. Belcher	256,112
Boring machine, wood, W. E. Lawrence	256,337
Bosom stretcher, R. Schmidt	256,384
Box. See Axle box. Tobacco and match box.	
Box fastener, W. Lang	256,224
Bracelet, W. Link	256,438
Brake. See Car brake.	
Bugs and worms, compound for destroying carpet, J. S. Vandenbergh	256,414
Burglar alarm, W. B. Howell	266,321
Burglar alarm, J. V. Knight	256,145
Burner. See Hydrocarbon burner. Lamp burner.	
Button, W. H. Ward	256,417
Button or stud, A. C. Greene	256,211
Buttons, instrument for attaching, J. W. Davis	256,297
Buttons, instrument for setting, F. H. Farnsworth	256,307
Calcining furnace, E. Protzman *et al.*	256,162
Car brake, D. P. Prescott	256,160
Car coupling, F. J. Blanke	256,277
Car coupling, F. F. Dearing	256,128
Car coupling, J. N. Dolas	256,202
Car coupling, L. King	256,495
Car coupling, C. D. McCormack	256,152
Car coupling, Moseby & Cessna	256,358
Car coupling, E. W. & S. C. Woolley	256,186
Car coupling tongues, die for manufacturing, W. C. Kroegher	256,147
Car propeller, J. H. Cole	256,292
Car, railway, J. Maclachlan	256,346
Car, stock, J. R. McPherson	256,153
Car, stock, J. H. Shellabarger	256,389
Car, stock, H. S. Wolfe	256,185
Car, track clearing, C. L. Heywood	256,140
Carriage jack, W. A. Foster	256,309
Cart, dumping, U. R. Nichols	256,362
Carving fork guard, J. B. H. Leonard	256,226
Case. See Clock case. Letter case. Show case.	
Casting car wheels, mould for, J. Thierry	256,410
Casting steel ingots, process of and machine for, G. W. Billings (r)	10,082
Castings, making cores for, L. G. Goldsmith	256,209
Chandeliers, counterbalance for extension, W. A. Hull	256,323
Child's chair tray, R. L. Bent	256,272
Chinoline, benzoate, Pickhardt & Endemann	256,445
Chinoline, salicylate of, Pickhardt & Endemann	256,444
Churn, R. H. G. Keeran	256,329
Churn dasher, F. T. Pinter	256,367
Clasp hook for shirt collars, detachable, S. S. Grannis	256,314
Clock and watch escapement, E. Wensch	256,418
Clock, calendar, C. Votti	256,255
Clock case, J. R. Lomas	256,340
Clock, electric, J. Schweizer	256,386
Clock, stop and waste, J. Kelly	256,222
Clutches, expanding and contracting device for friction, D. H. Merritt	256,286
Coffee and peanut roaster, C. L. Cole	256,428
Coffee and spice mill, J. F. Lawrence	256,225

© 1882 SCIENTIFIC AMERICAN, INC

Coffee percolator, J. C. Mackey 256,231
Coffee roaster, N. Harris 256,139
Collars, metallic pad for horse, A. C. Staples 256,172
Color producing acid, manufacture of a new, C. Rumpff 253,381
Colors treating certain derivatives of coal tar, E. D. Kendall 256,330
Colter, plow, M. A. Spink 256,250
Cooker, steam, A. M. Mace 256,230
Corn sheller, J. Q. Adams 256,261
Corsets, manufacture of, I. D. Warner 256,180
Cotton gin, T. Boatwright 256,195
Cotton gin and press, combined, P. K. Crowell 256,429
Coupling. See Car coupling. Hose coupling. Whiffletree coupling.
Coupling, F. Brown 256,280
Coupling pin for connecting rods, etc., W. E. Cooper 256,293
Creamer, centrifugal, Petersen & Nielsen 256,365
Crimping machine, J. W. D. Fifield 256,136
Cultivator, H. A. Robertson 256,374
Cultivator tooth, J. Morter 256,356
Cup. See Oil cup.
Cuspidor, G. C. Sterling 256,251
Cutter. See Bale band cutter. Vegetable cutter. Tobacco cutter.
Dash board, E. Rattey 256,370
Demijohn covering, F. A. & D. Bahr 256,267
Dental plugger, Johnson & Hough 256,143
Derrick, I. S. Reeves 256,371
Device for suspending persons in mid-air without visible support, E. H. J. Seeman 256,388
Die, stock, A. J. Signor 256,448
Door hanger, parlor, S. Shreffler, Jr 256,247
Drawers, mechanism for automatically fastening or locking a series of, A. B. Brundrett 256,119
Dyestuff or coloring matter, C. Rumpff 256,375
Dyestuff or coloring matter, J. H. Stebbins, Jr 256,401
Dyestuff or coloring matter, manufacture of, C. Rumpff ..... 256,376 to 256,380
Eel stop, L. M. Slade 256,394
Egg beater and mixer, G. B. Fowler 256,310
Electric machine, dynamo, H. B. Sheridan 256,391, 256,392
Electric machine, dynamo, W. Wheeler 256,182
Electrical carbons, draw plate for preparing fibrous filaments for, J. H. Guest 256,212
Electrical carbons, forming and treating, J. H. Guest 256,213
Electrical relay, C. Ader 256,262
Elevator. See Grain elevator. Ice elevator.
Elevator, J. B. Atwater 256,111
Elevator safety attachment, C. B. Morgan 256,354
Engine. See Rotary engine. Wind engine.
Envelope, K. H. Pedrick 256,241
Fare register and recorder, W. H. Hornum 256,320
Fence, H. P. Daviss 256,298
Fence, G. A. Horn 256,433
Fence wire barbing machine, F. P. Cady 256,121
Fertilizer distributer and planter, A. B. Farquhar *et al* 256,430
Fertilizer distributer and seed drill, combined, C. R. Straughn 256,404
Fertilizer distributer and seeder, J. W. Spangler 256,249
Fertilizers, reducing and mixing machine for, G. B. Berrell 256,115
Firearm, magazine, W. Trabue 256,175
Fire escape, G. W. Gibbs 256,207
Fire escape, Harrison & Folliard 256,317
Fire escape ladder, L. D. B. Shaw 256,447
Float ball for steam traps, etc., P. Barker 256,270
Floor, parquet, R. W. Eltzner 256,306
Flue cap, chimney, E. Blackman 256,194
Fruit bleaching apparatus, Lowell & Hooker 256,341
Fruit picker, J. R. & J. A. Williamson 256,421
Furnace. See Calcining furnace. Gas furnace.
Gauge. See Water gauge.
Gas, apparatus for making carbureted hydrogen, W. H. Taylor 256,406
Gas furnace, F. Dieckmann 256,132
Gas fixtures, clamp for extension, J. F. Brown 256,426
Gate. See Swinging gate.
Generator. See Magneto-electric generator.
Glove or shoe fastener, W. B. Carpenter 256,198
Governor, electrical, H. Linton 256,228
Grain binder, J. F. Appleby 256,188
Grain binder, G. B. Morton 256,257
Grain binder, J. L. Ware 256,179
Grain elevator, E. Roberts 256,244
Grain transporting device, T. F. Horen 256,319
Guard. See Carving fork guard.
Guns, shield for ship's, N. B. Clark 256,124
Hanger. See Door hanger.
Harvester cutter bar, N. Boren, Jr 256,279
Harvesting machine, A. Hurd 256,434
Harvesting machine, D. Maxwell 256,151
Harvesting machine, Smith & Hall 256,398
Hat, fireman's, I. Cairns 256,285
Hat holder, C. C. Lyon 256,343
Hat stretching machine, R. Eickemeyer 256,203, 256,305
Hat stretching machines ribbed former for, R. Eickemeyer 256,204
Hay rake and tedder, A. Eagle 256,134
Hay tedder and rake, combined, I. L. Landis 256,332
Heater, J. H. Mackintosh 256,345
Hides and skins, machine for treating, J. M. Jones 256,326
Hinge, A. Sweetland 256,405
Hinge, gate, I. L. Landis 256,333
Hinge, lock, S. Needles 256,361
Hoist, hog, J. Cunningham 256,200
Holder. See Hat holder. Label holder. Lamp shade holder. Lead and crayon holder. Paper bag holder. Spectacle holder.
Hook. See Clasp hook. Snap hook. Sewing machine hook.
Hose coupling and support, J. W. Regan 256,163
Hydrocarbon burner, E. A. Edwards 256,304
Hydrocarbon burner, liquid, S. H. Douglas 256,133
Ice elevator, S. A. Morton 256,155
Indicator. See Station indicator.
Indicator pistons, spring connection for, G. W. Brown 256,281
Inkstand, calendar, J. G. Smith 256,396
Jack. See Carriage jack.
Kiln for enamel work, A. Tees 256,407
Kitchen implement, J. W. Ross (r) 10,086
Label holder, car, C. J. Slafter 256,248
Lacing studs, making, M. Bray 256,116
Ladder, step, R. F. Jones 256,327
Lamp burner, argand, T. Hipwell 256,216
Lamp or lantern globes, chimneys, etc., manufacture of, Paull & Miller 256,158
Lamp shade holder, C. Votti (r) 10,087
Lantern, railway, W. O. Stephenson 256,402
Lead and crayon holder, G. Kistermann 256,223
Leather buffing machine, J. H. Stevens 256,252
Lemon squeezer, A. C. Rex 256,372
Letter case, revolving, A. S. Carrier 256,296
Lock. See Bedstead lock. Nut lock. Oar lock. Padlock. Trace lock. Trunk lock.
Lock, H. C. Aldrich 256,263
Locomotive, road, R. P. Bryson 256,120
Lubricator. See Axle lubricator.
Magneto-electric generator for signaling purposes, J. G. Arnold 256,189
Mail bag, E. P. Teeters 256,408
Mechanical movement, A. E. Rust 256,382
Metal bending and straightening machine, A. Wilke 256,260
Metal, chill for chilling, J. P. Warner 256,257
Meter. See Water meter.
Microtome, freezing, T. Taylor 256,173
Mill. See Coffee and spice mill. Windmill.
Mixing pulverized substances with liquids, device for, C. F. Binder 256,274
Monkey wrench, ratchet, W. F. McGregor 256,351
Motion, device for transmitting, E. L. Smith 256,395
Musical instrument mechanical, G. W. Ingalls 256,219
Naphthyl sulphate soda salt, production of, J. H. Stebbins, Jr 256,400
Nets, machine for making fish, J. Chaunier 256,287
Nut lock, Long & Richardson 256,149
Nut lock, J. Sherman 256,169
Oar lock, S. Irwin 256,324
Oatmeal machine, Eberhard & Turner (r) 10,084
Oil cup, steam engine, J. E. Lonergan 256,229
Oils, etc., treating mineral, R. Irvine 256,220
Ore crushing machine, S. R. Krom (r) 10,085
Ore, etc., machinery for pulverizing, F. J. & W. H. Hoyt 256,322
Ore separator, J. H. Wilhelm 256,183
Ore separator and concentrator, J. H. Wilhelm 256,184
Oven attachment, baker's, H. R. Gordon 256,313
Padlock, E. L. Perkins 256,159
Padlock, G. D. Spielman 256,399
Panels with artistic designs, producing metallic, H. R. Cassel 256,286
Paper bag holder, T. J. Graham 256,138
Paper bag machine, C. A. Chandler 256,123
Paper bags, making, C. Van Hoesen 256,177
Paper bags, manufacture of, M. L. Deering (r) 10,083
Paper stock, etc., treating fibrous materials for, J. O. Klimsch 256,436
Parer, corer, and slicer, apple, C. R. Heizmann 256,214
Pavement, concrete, J. J. Schillinger 256,383
Pen, fountain, P. P. Flournoy 256,206
Picker. See Fruit picker.
Pictures, method of and device for exhibiting, F. E. Mills 256,353
Pills, etc., machine for manufacturing, J. A. Whitney 256,420
Pills, process of and apparatus for making, J. A. Whitney 256,419
Pin. See Coupling pin.
Pipe section for tanks, removable, C. G. Mayer 256,349
Piston head, H. D. Garrett 256,312
Plaiting machine, S. I. Echols 256,302
Pliers for attaching buttons, W. H. Ward 256,416
Plow bolt, chilled, T. M. Bissell 256,275
Plow, cotton, D. R. Matheny 256,348
Plow, sulky, Wood & Pratt 256,422
Pocket, safety, S. E. Bushnell 256,196
Pot. See Tempering pot.
Press. See Printing press.
Printing machine delivery table, T. Nourse 256,363
Printing press, plate, T. S. Bates (r) 10,080
Printing press, plate, J. Tregurtha 256,413
Pulley grinding machine, P. Medart 256,440
Pulley spiders, machine for grinding, P. Medart 256,441
Pump, W. H. Cloud 256,126
Pump, air, N. B. Blackmer 256,276
Pump attachment, H. Clayton 256,125
Pump, chain, D. E. Shaw 256,167
Rag beater, G. Miller 256,352
Railway crossing, automatic, D. Lee, Jr 256,437
Railway frog safety attachment, E. S. Eveleigh 256,135
Railway signaling apparatus, W. H. Bachtel 256,266
Railway tie, J. Clark 256,199
Rake. See Hay rake.
Recorder. See Steam engine recorder.
Refrigerating and preserving meat, etc., E. N. Dickerson, Jr 256,299
Refrigerating apparatus, C. G. Mayer 256,350
Register. See Fare register.
Regulator. See Windmill regulator.
Relay and sounder, C. G. Burke 256,427
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Spring. See Bed spring. Vehicle spring.
Stamp, hand, W. H. Poole 256,242, 256,243
Starch separator, Graves & Heede 256,315
Starch table, T. A. & W. T. Jebb 256,221
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Steam engine recorder, G. H. Crosby 256,294, 256,295
Step cover, W. E. Lawrence 256,336
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Stove grate, adjustable, De Guerre & Lano 256,180
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Stove pipe shelf, H. Clayton 256,290
Strap. See Boot strap.
Surveying instrument, G. W. Hill 256,142
Swinging gate, I. L. Landis 256,331
Table. See Billiard table. Printing machine delivery table. Starch table.
Target flying, G. Ligowsky 256,227
Telegraph, chemical, W. C. Taucke 256,253
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Telephone exchange system, T. A. Watson 256,258
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Velocipede, E. Edwards 256,303
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Windmill, G. W. Miller 256,154
Windmill regulator, Lamont & White 256,334
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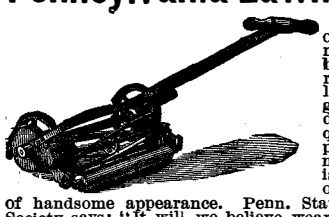

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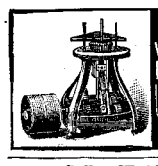

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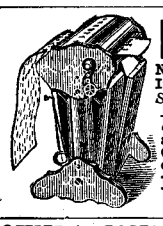

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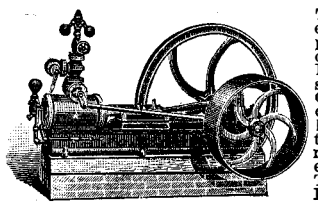

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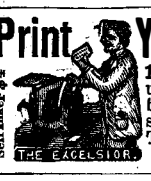

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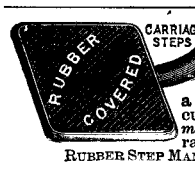

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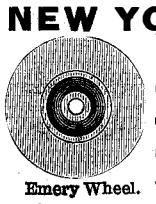

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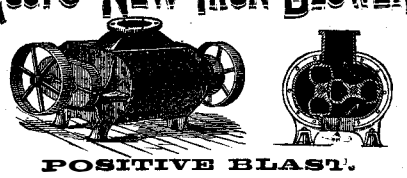

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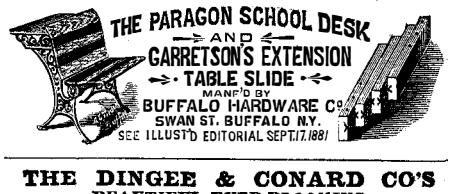

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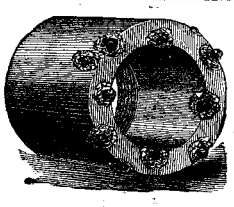

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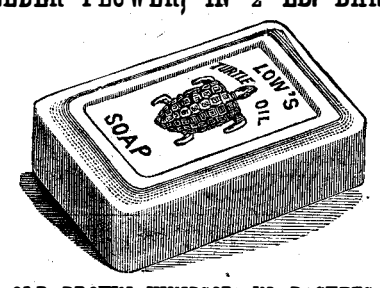

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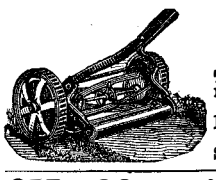

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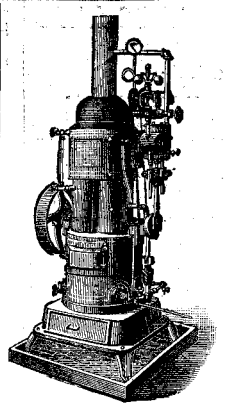

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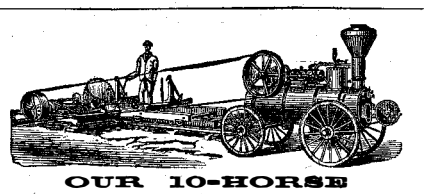

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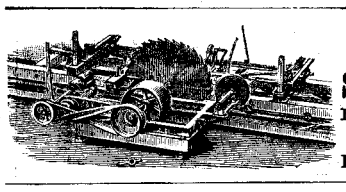

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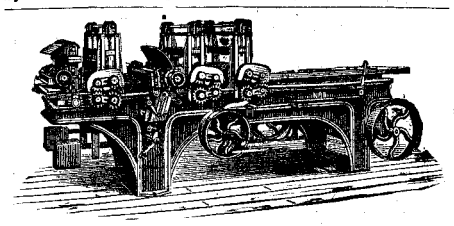

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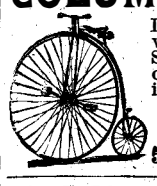

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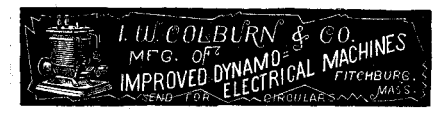

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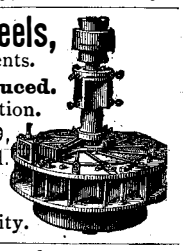

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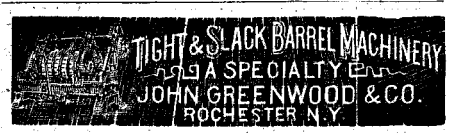

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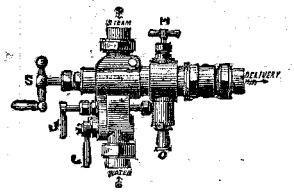

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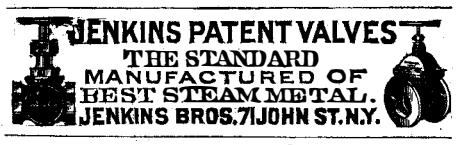

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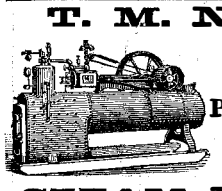

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